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ORIGINAL RESEARCH

Impact of comprehensive nursing based on the ``3H'' theory on blood gas, recovery speed and lung function in children with severe pneumonia

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Abstract

Background: This study aims to evaluate the effects of comprehensive nursing based on the "3H" theory on blood gas parameters, recovery speed and lung function in children with severe pneumonia. **Methods**: An analysis was conducted on clinical data from 90 children diagnosed with severe pneumonia who were treated at our hospital between November 2022 and December 2023. They were randomly divided into two groups based on the computer random number table method: a study group, which received comprehensive nursing based on the "3H" theory in addition to routine care (n = 45), and a control group, which received only routine care (n = 45). The recovery speed, blood gas indexes, lung function indexes, and family satisfaction were compared between the two groups. **Results**: Before treatment, there were no significant differences between the two groups in terms of arterial partial pressure of oxygen (PaO_2), arterial oxygen saturation (SaO_2), arterial partial pressure of carbon dioxide ($PaCO_2$), forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC), maximum voluntary ventilation (MVV), peak expiratory flow (PEF) and the ratio of FEV_1 to FVC (FEV_1/FVC) ($p > 0.05$). After treatment, the study group showed higher compliance, family satisfaction, FEV_1, FVC, MVV, PEF, PaO_2 and SaO_2 levels, and shorter times for cough relief, fever reduction, improvement in shortness of breath, disappearance of lung rales, hospitalization and $PaCO_2$ levels. These differences were all statistically significant ($p < 0.05$). **Conclusions**: Comprehensive care under the "3H" theory can significantly improve the recovery speed, blood gas levels, pulmonary function and family satisfaction in children with severe pneumonia. **The ISRCTN Registration**: ISRCTN13393172.

Keywords

"3H" theory; Comprehensive nursing; Severe pneumonia; Blood gas indicators; Recovery speed; Lung function

1. Introduction

Pneumonia is a common condition in children, typically caused by pathogens such as bacteria, viruses, Mycoplasma and fungi [1]. Due to their underdeveloped immune systems and the often atypical early symptoms of pneumonia, the disease can rapidly progress to severe pneumonia [2], which can then significantly impair their respiratory function, leading to rapid deterioration of blood gas parameters and lung function [3]. Thus, if not managed properly, it can pose life-threatening risks, highlighting the need for timely and effective intervention. Children undergoing treatment for severe pneumonia can be influenced by factors such as their developmental stage, illness severity and environmental conditions, which can lead to disease recurrence, emotional instability and poor treatment adherence [4]. Therefore, comprehensive, efficient and precise nursing interventions are essential. At the current stage, conventional nursing for severe pneumonia often faces issues such as a single-mode approach, lack of psychological support [5] and untimely responses to the needs of children and their families. As a result, the nursing outcomes are less than ideal. Comprehensive care under the "3H" theory is a nursing approach that integrates hotel-style (Hotel) etiquette services, hospital (Hospital) personalized care services and home-style (Home) warm services. Compared to general personalized care, it offers significant advantages.

Its service model is more comprehensive. The hotel-style etiquette service can enhance the nurse-patient relationship. It deepens and expands personalized care through multidisciplinary collaboration, providing dynamic services for the child and strengthening the recovery of indicators such as blood gas levels and pulmonary function. The approach emphasizes psychological support and humanistic care, with home-style services [6] creating a comforting environment and offering

emotional reassurance and encouragement to the family. The response to needs is timely and proactive, improving the overall quality and efficiency of nursing services.

In this present study, we investigated the effects of comprehensive nursing based on the "3H" theory on blood gas parameters, recovery speed, and lung function in children with severe pneumonia.

2. Materials and methods

2.1 Study subjects

Our study was registered in ISRCTN (registration number: ISRCTN13393172) and can be found at https://www.isrctn.com/ISRCTN13393172.

2.2 General information

A total of 90 children with severe pneumonia who were admitted to our hospital between November 2022 and December 2023 were selected as the study subjects. According to the computer random number table method, they were randomly divided into a study group (n = 45) and a control group (n = 45). In the study group, there were 24 males and 21 females, aged 3 to 16 years, with an average age of (11.82 ± 1.60) years. The duration of illness ranged from 2 to 8 days, with an average duration of (4.17 ± 0.55) days. Upon admission, the body temperature ranged from 38.4 °C to 40.2 °C, with an average of 39.18 ± 0.52 °C. Disease severity was graded as follows: 12 cases of grade I, 10 cases of grade II, 15 cases of grade III and 8 cases of grade IV. The pathogens identified included Mycoplasma infection in 17 cases, viral infection in 18 cases, and bacterial infection in 10 cases. The average score on the Gesell Developmental Scale was (102.36 ± 10.36) points.

In the control group, there were 23 males and 22 females, aged 4 to 17 years, with an average age of (12.02 ± 1.45) years. The duration of illness ranged from 2 to 9 days, with an average duration of (4.22 ± 0.53) days. Upon admission, the body temperature ranged from 38.3 °C to 40.1 °C, with an average of 39.16 ± 0.53 °C. Disease severity was graded as follows: 11 cases of grade I, 11 cases of grade II, 14 cases of grade III and 9 cases of grade IV. The pathogens identified included Mycoplasma infection in 16 cases, viral infection in 17 cases and bacterial infection in 12 cases. The average score on the Gesell Developmental Scale was (102.85 ± 10.24) points.

There were no significant differences in the general data between the two groups ($p > 0.05$), indicating that they were comparable.

2.3 Inclusion and exclusion criteria

2.3.1 Inclusion criteria

① Diagnosed by X-ray, meeting the diagnostic criteria of "Pediatrics (8th edition)" [7].

② Good compliance.

③ No history of drug allergies.

④ The child's family members should have at least a primary school education.

⑤ The child's family members agree to participate and sign the informed consent form.

2.3.2 Exclusion criteria

① Suffering from other severe pulmonary diseases.

② Complicated with liver or kidney dysfunction.

③ Suffering from mental disorders.

④ Complicated with other malignant tumors.

⑤ Complicated with severe malnutrition.

⑥ Complicated with congenital heart disease.

2.4 Methods

All enrolled children were assigned a number, and a random number generator was used to generate a sequence of random numbers corresponding to the number of children. Odd numbers were assigned to the study group, while even numbers were assigned to the control group. After admission, both groups of children received anti-infection treatment, oxygen support as needed, intravenous fluid therapy to correct dehydration and electrolyte imbalances and nutritional support through oral/nasal feeding. Vital signs, including body temperature, heart rate, respiration and blood pressure, were closely monitored throughout the process.

The control group received conventional nursing care.

(1) Close monitoring of the child's condition, enhancing the monitoring of vital signs such as heart rate, respiration and blood pressure. Changes in consciousness, mental state, complexion and lip color were observed, with special attention paid to early signs of complications such as respiratory failure, heart failure or septic shock. Any changes were communicated promptly to the physician for appropriate management.

(2) Respiratory management was provided according to the patient's condition, including suctioning as needed, along with high-flow oxygen therapy to alleviate hypoxic stimuli. Airway humidification was implemented, and the room's air humidity (50%–60%) was adjusted to help dilute and promote the expectoration of mucus.

(3) Psychological support was strengthened. Psychological comfort was provided to the children according to their age and psychological characteristics, using various methods to offer comfort and encouragement. Psychological support was also extended to the families, with attention given to their emotional state. Family meetings or one-on-one communications were organized regularly to discuss the child's condition and treatment plan, addressing any concerns or questions the family may have had.

(4) Family involvement and ward optimization were emphasized. Family members received nursing training to improve their care skills. The ward environment was kept fresh, minimizing noise and reducing excessive light exposure.

(5) Strengthening collaboration within the medical and nursing teams. Multidisciplinary collaboration was carried out, including regular case discussions and consultations. Communication and cooperation with pediatricians, pulmonologists, nutritionists, rehabilitation therapists and other specialists were encouraged. Continuous efforts were made to improve nursing quality, and a nursing quality monitoring team was set up to examine and assess nursing practices on a regular basis and quickly address any problems. Emergency drills were conducted regularly, focusing on potential acute situations that could arise with severe pneumonia cases, aiming to improve

the medical team's emergency response and coordination capabilities.

The study group received comprehensive nursing care based on the "3H" theory in addition to the standard care provided to the control group. This approach included the following components:

1. Hotel-style (Hotel) service: Nursing staff adhered to hotel service standards by maintaining professional attire, posture and a polite demeanor. They warmly greeted the children and their families, promptly addressing their needs with a positive attitude. Respectful communication was emphasized through both verbal and non-verbal expressions of care. The nursing staff explained treatment procedures and precautions in detail to build trust between the child, family and the medical team. Upon discharge, the nurses provided assistance with formalities and explained post-discharge care to ensure continuity of treatment.

They patiently explained treatment details and precautions, continuously enhancing trust between the child and their family. Upon discharge, they actively assisted the family with procedures and explained post-discharge treatment continuation and related matters.

2. Hospital-style (Hospital) service: Comprehensive assessments were conducted by nursing staff, taking into account the child's disease progression, psychological state, family background and economic circumstances. Individualized nursing plans were developed based on these assessments, with ongoing adjustments made in response to changes in the child's condition. Regular communication was maintained with the child and family to understand their needs and expectations. Additionally, close collaboration with the interdisciplinary medical team ensured that nursing plans were both scientifically sound and feasible.

3. Home-style (Home) service: A warm and comforting hospital environment was created, with the use of child-friendly decor and green plants to make the room feel more homelike. Nursing staff attended to the child's daily needs, ensuring comfort and facilitating family involvement in the care process to enhance the child's sense of support and improve adherence to treatment. Cleanliness and hygiene were prioritized, with regular disinfection to maintain a safe environment. Emotional support was also extended to family members, helping them manage anxiety and fatigue during the child's hospitalization.

2.5 Observational indicators

(1) Recovery Speed: The recovery speed between the two groups was compared by observing the following parameters:

- Cough cessation time: The time when the child's cough symptoms completely disappear.

- Fever reduction time: The duration required for the child's body temperature to return to normal, measured using an electronic thermometer or medical infrared thermometer.

- Shortness of breath improvement time: The time it takes for the child's shortness of breath symptoms to improve.

- Lung rales disappearance time: The time when lung rales disappear, determined by auscultation or other means.

- Hospitalization time: The duration from the child's admission to discharge.

(2) Blood Gas Indicators: Arterial blood samples (1 mL) were collected from both groups of children before and after the intervention for blood gas analysis. PaO_2, SaO_2 and $PaCO_2$ were compared between the two groups.

(3) Pulmonary Function Indicators: The changes in the pulmonary function parameters, including FEV_1, FVC, MVV, PEF and the FEV_1/FVC ratio, were compared between the two groups.

(4) Family Satisfaction: A self-designed anonymous satisfaction questionnaire was used to assess the satisfaction of the child's family with the nursing care [8]. This survey includes six aspects: nursing attitude, psychological support, environmental maintenance, communication effectiveness, disease control and professional competence, with a total score of 100 points. A score of $\geq$95 was considered "very satisfied", 85–95 "satisfied", 65–85 "generally satisfied" and $<$65 "dissatisfied". The satisfaction rate was calculated as:

Satisfaction rate = (1 $-$ dissatisfied cases/total cases) $\times$ 100%.

The Cronbach's α coefficient of the questionnaire was 0.941, indicating good reliability and validity.

(5) Compliance: A self-designed children's treatment compliance scale was used to evaluate the children's compliance [9]. This scale includes two aspects: emotional and behavioral compliance, with a score range of 18 to 72 points. A score above 50 indicates compliance, while a score of $\leq$49 indicates non-compliance.

2.6 Statistical analysis

Data analysis was performed using SPSS 27.0 statistical software (IBM, Armonk, NY, USA). Measurement data were expressed as mean $\pm$ standard deviation ($\bar{x} \pm s$), and intergroup comparisons were made using the t-test. Categorical data were expressed as frequency and percentage, with intergroup comparisons made using the χ^2 test. A p-value of $<$ 0.05 was considered statistically significant.

3. Results

3.1 Comparison of recovery speed between the two groups

After treatment, the study group demonstrated significantly shorter times for cough cessation, fever resolution, improvement in dyspnea, disappearance of pulmonary rales, and overall length of hospital stay compared to the control group ($p <$ 0.05), as shown in Table 1.

3.2 Comparison of blood gas parameters between the two groups

Before treatment, no significant differences were observed in the PaO_2, SaO_2 and $PaCO_2$ levels between the two groups ($p >$ 0.05). However, after treatment, the study group exhibited significantly higher PaO_2 and SaO_2 levels and lower $PaCO_2$ levels compared to the control group ($p <$ 0.05) (Table 2).

TABLE 1. Comparison of recovery speed between the two groups ($\bar{x} \pm s$, d).

Group	Number of cases	Cough cessation time	Fever resolution time	Dyspnea improvement time	Disappearance time of pulmonary rales	Length of hospital stay
Study group	45	5.38 ± 0.53	3.91 ± 0.51	4.73 ± 0.50	5.36 ± 0.53	8.56 ± 0.84
Control group	45	7.24 ± 0.74	4.84 ± 0.56	6.31 ± 0.63	7.18 ± 0.72	15.16 ± 1.61
t value	—	13.676	8.215	13.164	13.727	24.387
p value	—	<0.001	<0.001	<0.001	<0.001	<0.001

TABLE 2. Comparison of blood gas parameters between the two groups ($\bar{x} \pm s$).

Indicators	Study group (n = 45)	Control group (n = 45)	t value	p value
PaO_2 (mmHg)				
Before Treatment	46.98 ± 4.82	47.14 ± 4.67	−0.160	0.873
After Treatment	85.78 ± 8.61	77.31 ± 7.65	4.933	<0.001
t value	−25.300	−21.828		
p value	<0.001	<0.001		
SaO_2 (%)				
Before Treatment	59.88 ± 6.17	60.18 ± 5.92	−0.235	0.408
After Treatment	98.72 ± 9.85	95.05 ± 9.61	1.789	0.040
t value	22.417	20.724		
p value	<0.001	<0.001		
$PaCO_2$ (mmHg)				
Before Treatment	53.22 ± 5.59	53.48 ± 5.37	−0.217	0.829
After Treatment	39.47 ± 3.84	45.83 ± 4.67	−7.076	<0.001
t value	12.375	8.203		
p value	<0.001	<0.001		

PaO_2: arterial partial pressure of oxygen; SaO_2: arterial oxygen saturation; $PaCO_2$: arterial partial pressure of carbon dioxide.

3.3 Comparison of lung function indicators between the two groups

Before treatment, our data showed that there were no significant differences between the two groups in terms of FEV_1, FVC, MVV and PEF ($p > 0.05$) (Table 3). However, after treatment, the study group showed significantly higher levels of FEV_1, FVC, MVV and PEF compared to the control group (Fig. 1, $p < 0.05$).

3.4 Comparison of family satisfaction between the two groups

Family satisfaction after treatment was significantly higher in the study group compared to the control group ($p < 0.05$), as shown in Table 4.

3.5 Comparison of compliance between the two group

After the intervention, the study group had higher compliance compared to the control group, and the difference was statistically significant ($p < 0.05$). See Table 5.

4. Discussion

Due to the immature immune system and cognitive development, children with severe pneumonia often experience fear, anxiety and resistance to treatment [10], which leads to prolonged treatment cycles, suboptimal treatment outcomes, and frequent relapses. To improve the recovery speed, effectively enhance blood gas indicators and optimize pulmonary function, precise, reasonable and comprehensive nursing interventions are necessary. At the current stage, conventional nursing for severe pneumonia primarily focuses on disease surveillance, medication treatment and basic daily care [11], lacking attention to the psychological needs of the child, personalized care and family support. This ultimately results in poor overall nursing outcomes. Comprehensive care under the "3H" theory integrates hospital (Hospital)-style care [12], home (Home)-style care and hotel (Hotel)-style care. It provides holistic support for the child and family through personalized care plans, humanistic care, psychological support and proactive needs response. This approach not only accelerates the child's recovery but also enhances family satisfaction and recognition. In this study, the study group showed shorter times for cough cessation, fever reduction, improvement in shortness of breath,

TABLE 3. Comparison of lung function indicators between the two groups ($\bar{x} \pm s$).

Indicators	Study group (n = 45)	Control group (n = 45)	*t* value	*p* value
FEV_1 (L)				
Before Treatment	1.48 ± 0.56	1.52 ± 0.53	−0.437	0.663
After Treatment	3.54 ± 0.52	2.81 ± 0.51	6.570	<0.001
t value	−16.529	−12.729		
p value	<0.001	<0.001		
FVC (L)				
Before Treatment	1.22 ± 0.55	1.26 ± 0.53	−0.354	0.724
After Treatment	2.34 ± 0.51	1.76 ± 0.52	5.341	<0.001
t value	−9.784	−3.848		
p value	<0.001	<0.001		
MVV (L)				
Before Treatment	49.02 ± 5.11	49.14 ± 4.96	−0.122	0.903
After Treatment	59.47 ± 5.95	51.75 ± 5.18	6.556	<0.001
t value	−8.646	−2.466		
p value	<0.001	<0.001		
PEF (L/min)				
Before Treatment	162.25 ± 16.75	162.86 ± 16.43	−0.174	0.862
After Treatment	198.64 ± 19.91	178.32 ± 17.23	5.175	<0.001
t value	−10.559	−4.709		
p value	<0.001	<0.001		
FEV_1/FVC				
Before Treatment	61.65 ± 6.23	61.84 ± 6.17	0.145	0.443
After Treatment	80.57 ± 8.10	72.71 ± 7.31	4.832	<0.001
t value	12.420	7.623		
p value	<0.001	<0.001		

FEV_1: forced expiratory volume in 1 second; FVC: forced vital capacity; MVV: maximum voluntary ventilation; PEF: peak expiratory flow.

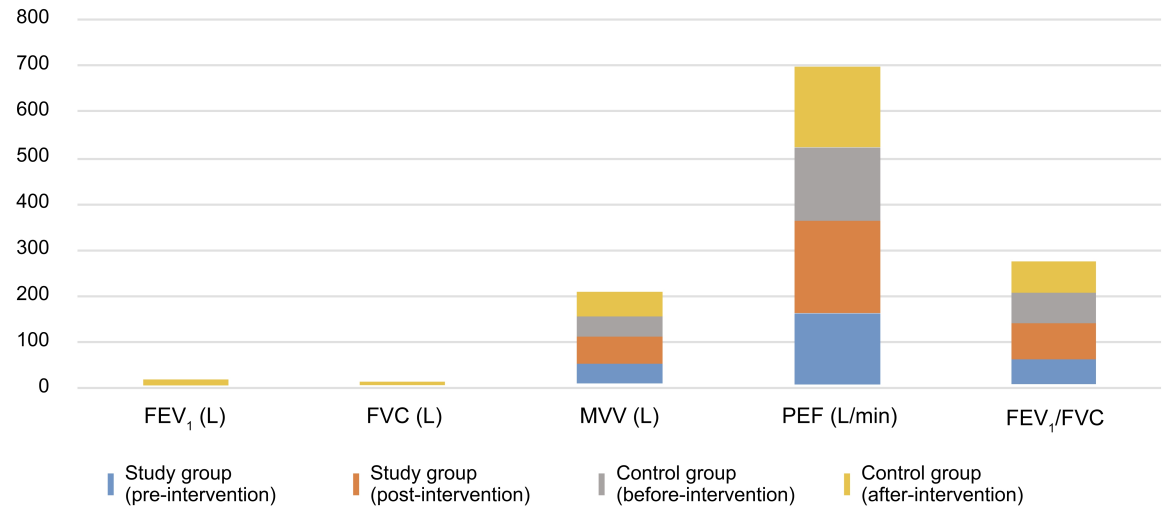

FIGURE 1. Comparison of pulmonary function indicators between the two groups. FEV_1: forced expiratory volume in 1 second; FVC: forced vital capacity; MVV: maximum voluntary ventilation; PEF: peak expiratory flow.

TABLE 4. Comparison of family satisfaction between the two groups (n, %).

Group	Number of cases	Very satisfied	Satisfied	Moderately satisfied	Unsatisfied	Level of Satisfaction
Study group	45	22, 48.89	12, 26.67	10, 22.22	1, 2.22	44, 97.78
Control group	45	17, 37.78	9, 20.00	11, 24.44	8, 17.78	37, 82.22
χ^2 value	—			—		6.049
p value	—			—		0.014

TABLE 5. Comparison of compliance between the two groups ($\bar{x} \pm s$, score).

Group	Number of cases	Compliance cases	Compliance rate (%)
Study group	45	42	93.33
Control group	45	34	75.56
χ^2 value	—	—	5.414
p value	—	—	0.020

disappearance of lung rales and hospitalization, with all differences being statistically significant ($p < 0.05$). This suggests that comprehensive care under the "3H" theory can accelerate the recovery speed of children. The reason may be that hospital (Hospital)-style care is more targeted. Based on personalized care plans, it allows for quick and accurate identification of the cause of the child's cough, real-time monitoring of body temperature, timely respiratory management, and the addition of measures such as nebulization, airway secretion clearance and reasonable cooling, based on the child's condition [13]. These actions reduce airway irritation, maintain airway patency and minimize temperature fluctuations [14]. Home (Home)-style care provides a comfortable and warm recovery environment, which can effectively regulate the child's emotional fluctuations and enhance their immune function, thus promoting recovery. Hotel (Hotel)-style care offers more proactive service, improving the effectiveness of treatment drugs and measures through health education, optimized respiratory management, and anti-infection care.

When lung infection and inflammation occur, alveolar consolidation, alveolar collapse and airway obstruction can impair gas exchange in the body. Insufficient oxygen intake leads to a decrease in PaO_2 and SaO_2 [15], while impaired carbon dioxide elimination results in an increase in $PaCO_2$. In this study, the study group exhibited higher levels of PaO_2 and SaO_2, and lower levels of $PaCO_2$, with all differences being statistically significant ($p < 0.05$). This suggests that comprehensive care under the "3H" theory can improve the blood gas levels in children.

The reason may be that hospital (Hospital)-style care supports personalized respiratory care, combining respiratory management and anti-infection treatments to increase the partial pressure of oxygen in the alveoli, improve the function of the gas exchange barrier, and elevate PaO_2 and SaO_2 levels [16]. Home (Home)-style care supports respiratory training for children, strengthening respiratory muscle strength and endurance, while also improving respiratory efficiency through position care [17] and respiratory management, allowing more carbon dioxide to be exhaled [18]. Hotel (Hotel)-style care helps the child maintain a relaxed and calm emotional state during treatment, reducing rapid breathing caused by anxiety and tension. Severe pneumonia can cause congestion, edema of the alveoli and bronchial mucosa, and even destruction of alveolar structures and alveolar fusion [19], ultimately leading to respiratory muscle fatigue and decreased lung compliance.

In this study, the research group showed higher levels of FEV_1, FVC, MVV and PEF, with significant differences ($p > 0.05$). This suggests that the comprehensive care under the "3H" theory can effectively improve the lung function of children. The reason may be that hospital-based care allows for the development of personalized respiratory training plans for the children, combined with airway management and nutritional support, which enhances the strength and endurance of respiratory muscles, enabling more forceful expulsion of air during the early phase of exhalation [20]. Home-based care enables deep involvement of family members, who assist with clinical treatments, provide accompanying care, and help the child's lung inflammation subside more quickly, reducing edema in the alveoli and interstitium and improving lung elasticity [21]. Hotel-style care improves the child's psychological state, relaxing the respiratory muscles, and enhancing the coordination and depth of breathing. In this study, the research group showed higher family satisfaction and child compliance, with significant differences ($p > 0.05$). This suggests that the comprehensive care under the "3H" theory significantly improved the satisfaction of the families of children with severe pneumonia and the compliance of the children. The reasons may be that, in hotel-style care, the enthusiastic, friendly and professional attitude of the healthcare staff made families feel respected and cared for, while the children felt encouraged and supported. Close and effective communication, along with strengthened psychological support, increased the family's and child's engagement and cooperation in the care process [22]. In hospital-based care, the personalized plans tailored to the child's condition and individual differences were more targeted, increasing the family's confidence in the treatment. Home-based care created a warm and comfortable environment, which enhanced the effectiveness of care and alleviated the tension and anxiety that families and children might feel during the medical process.

However, this study still has limitations such as small sam-

ple, potential confounding factors in the research design, and difficulties in standardizing the implementation of nursing interventions. Sample size limitation: Although 90 patients were ultimately analyzed, the sample size is relatively small, which may affect the statistical significance and generalizability of the results. Potential confounding factors: Despite random grouping in the study design, there may still be uncontrolled confounding factors. These could include patient age, gender, disease duration, comorbidities, socioeconomic status and social support, all of which may influence the recovery rate and treatment outcomes. Standardization of nursing interventions: When implementing comprehensive nursing measures based on the "3H" theory, inconsistencies in execution may arise. The professional level, experience and understanding of the "3H" theory among different nursing staff may affect the consistency and effectiveness of the intervention. Such variations could lead to bias in the results, impacting the assessment of intervention effectiveness. The next step will be to conduct a multi-center, large-sample study, optimize the research design, control confounding factors, expand and refine observation indicators, and organize standardized nursing intervention implementation and training, in order to enhance the scientific and rigorous nature of the research.

5. Conclusions

In summary, comprehensive care based on the "3H" theory can significantly accelerate the recovery of children with severe pneumonia, improve blood gas levels, regulate lung function and increase family satisfaction.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

XYL and JJ—designed the study and carried them out; prepared the manuscript for publication and reviewed the draft of the manuscript. XYL, JJ, CJL, WDY, XNX, XCC—supervised the data collection; analyzed the data. XYL, JJ, CJL, XNX, XCC—interpreted the data. All authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethics Committee of the Second Affiliated Hospital & Yuying Children's Hospital of Wenzhou Medical University (Approval no. 2021-K-331-03). The child's family members agree to participate and sign the informed consent form.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Zhu Z, Zhang T, Guo W, Ling Y, Tian J, Xu Y. Clinical characteristics of refractory mycoplasma pneumoniae pneumonia in children treated with glucocorticoid pulse therapy. BMC Infectious Diseases. 2021; 21: 126.

[2] Zheng Y, Hua L, Zhao Q, Li M, Huang M, Zhou Y, *et al*. The level of D-dimer is positively correlated with the severity of mycoplasma pneumoniae pneumonia in children. Frontiers in Cellular and Infection Microbiology. 2021; 11: 687391.

[3] Zhou Y, Hu M, Ye B, Chen Z, Zhang Y. Early prediction of necrotizing pneumonia from mycoplasma pneumoniae pneumonia with large pulmonary lesions in children. Scientific Reports. 2020; 10: 19061.

[4] Zhao Q, Yang J, Sheng Y, Zhuang M, Qi M. Study on the therapeutic effect of azithromycin combined with glucocorticoid on pulmonary function and inflammatory response in children with pneumonia. Journal of Healthcare Engineering. 2022; 2022: 5288148.

[5] Luo W, Liu Y, Wen C, Chen X, Zhang J. Bundled care combined with animated educational videos can promote the recovery of severe pneumonia in children: a case-control study. Medicine. 2024; 103: e38437.

[6] Li J. The effect of personalized comprehensive care on the nursing care of severe pneumonia patients. Journal of Clinical and Nursing Research. 2024; 8: 71–77.

[7] Sheikh M, Ahmad H, Ibrahim R, Nisar I, Jehan F. Pulse oximetry: why oxygen saturation is still not a part of standard pediatric guidelines in low-and-middle-income countries (LMICs). Pneumonia. 2023; 15: 3.

[8] Bai L, Yang L, Shi X, Huang W. Effect of PDCA circulation nursing intervention on prognosis of patients with severe pneumonia. American Journal of Translational Research. 2022; 14: 252–263.

[9] Shahrin L, Chisti MJ, Shahid ASMSB, Rahman ASMMH, Islam MZ, Afroze F, *et al*. Injectable amoxicillin versus injectable ampicillin plus gentamicin in the treatment of severe pneumonia in children aged 2 to 59 months: protocol for an open-label randomized controlled trial. JMIR Research Protocols. 2020; 9: e17735.

[10] Wang M, Li H, Yang J, Wang M, Liu J. Clinical efficacy enhancement of a Chinese herbal injection in the treatment of mycoplasma pneumonia in children: a protocol of randomized controlled trial. Medicine. 2021; 26: e25135.

[11] Zimmerman S, Sloane PD, Ward K, Wretman CJ, Stearns SC, Poole P, *et al*. Effectiveness of a mouth care program provided by nursing home staff *vs*. standard care on reducing pneumonia incidence: a cluster randomized trial. JAMA Network Open. 2020; 3: e204321.

[12] Levitt D. Transforming the hospital-style nursing home to a centre for living. Healthcare Management Forum. 2022; 35: 35–38.

[13] Field MR, Ambroggio L, Lorenz D, Shah SS, Ruddy RM, Florin TA. Time to clinical stability in children with community-acquired pneumonia. Pediatrics. 2024; 153: e2023063480.

[14] Wang X, Qiu Y, Xu T, Chen Y, Ying C. Effect observation of optimized individualized nursing care applied to ICU patients with severe pneumonia. Emergency Medicine International. 2022; 2022: 6529558.

[15] Yang W, Zhang L. Observation of the curative effect of conservative oxygen therapy in mechanical ventilation of patients with severe pneumonia. Chinese Critical Care Medicine. 2021; 33: 1069–1073. (In Chinese)

[16] Wang S, Dong Y, Wang J, Leng L, Song X, Huang W. The protective effect of ulinastatin combined with Xuebijing on myocardial injuries in patients with severe pneumonia. American Journal of Translational Research. 2021; 13: 11745–11751.

[17] Zhang M, Li X, Bai Y. Prone position nursing combined with ECMO intervention prevent patients with severe pneumonia from complications

and improve cardiopulmonary function. American Journal of Translational Research. 2021; 13: 4969–4977.

[18] Wang ZL, He Y, Luo ZX. Continuous positive airway pressure in children with severe pneumonia: a meta-analysis. World Journal of Pediatrics. 2020; 16: 637–641.

[19] Xue M, Da C. The protective effect of Qingfei Huatan decoction on pulmonary function and its influence on the immunological function in children with severe pneumonia. American Journal of Translational Research. 2021; 13: 9404–9412.

[20] Xiao T, Chen F, Wan Z. Study on effects of care bundles on patients with severe pneumonia complicated with respiratory failure. American Journal of Translational Research. 2021; 13: 10942–10949.

[21] Wang M, Li J, Li W, Tian H, Kang X. The effect of EBN combined with integrated hierarchical accountability nursing on patients with severe pneumonia. American Journal of Translational Research. 2021; 13: 5610–5616.

[22] Yu T, Wang N, Li A, Xu Y. Clinical evaluation of targeted sedation nursing combined with comprehensive nursing in children with severe pneumonia. Medicine. 2024; 103: e36317.

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