

Original Article

Efficacy of the PDCA cyclic care model in improving lung function and speed of recovery in children with mycoplasma pneumonia

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Abstract: Objective: To explore the effect of Plan-Do-Check-Act (PDCA) cycle nursing on the prognosis of children with mycoplasma pneumonia (MMP). Methods: Clinical data of 112 children with MMP who were admitted to Hangzhou Ninth People's Hospital from September 2020 to December 2022 were retrospectively analyzed. The children were divided into a control group (56 cases, receiving routine care) and a PDCA group (56 cases, receiving PDCA care) according to nursing interventions. Blood gas analysis, pulmonary function, inflammation levels, clinical treatment, complications, and satisfaction were compared between the two group pre- and post-care. Results: The results showed that the children in PDCA group experienced a more significant improvement in blood oxygen levels, evidenced by increased PaO₂ and SaO₂ levels and decreased PaCO₂ levels, as well as enhanced lung function. Meanwhile, PDCA care was more effective in reducing interleukin-6, C-reactive protein, and tumor necrosis factor-alpha levels in children. In addition, children in the PDCA group recovered more quickly, with shorter times to temperature normalization, cough improvement, asthma resolution, lung rales disappearance, and hospital stay. Moreover, PDCA nursing effectively reduced the incidence of intrapulmonary and extrapulmonary complications, and improved care quality and patient satisfaction. Conclusions: The PDCA cycle nursing model significantly improves the prognosis of children with MMP by promoting faster recovery, reducing adverse reactions, and enhancing overall nursing satisfaction. This approach fosters a more harmonious doctor-patient relationship, contributing to better patient outcomes and a more effective care environment.

Keywords: PDCA cycle of care, mycoplasma pneumonia, lung function, prognosis

Introduction

Mycoplasma pneumonia (MMP), a respiratory tract infection caused by Mycoplasma, is a common illness in children [1]. Recently, the incidence of MMP has been increasing due to pathogen mutation, irrational antibiotic use, low immunity levels in children, and environmental pollution [2, 3]. Since the autumn and winter of 2023, MMP infections have surged nationwide in China, placing significant pressure on the healthcare system. Given that children with MMP are younger and have lower cognitive function compared to adults, effective nursing and rehabilitation training are crucial for improving clinical efficacy and promoting recovery [4]. However, there is a serious shortage of nursing staff in China, particularly in pediatrics, where the demand for professional training and work intensity are huge, plus there

is insufficient social recognition of these valuable healthcare workers [5]. This shortage leads to inadequate care for children with MMP, leading to risks such as insufficient treatment, lack of psychological support, increased complications, and prolonged recovery time [6]. Furthermore, traditional nursing approaches often do not consider the child's perspective, leading to lower compliance, awareness, and effectiveness in nursing care. Therefore, improving care models to provide effective and targeted care for children with MMP is essential to addressing the shortage of pediatric nursing staff.

The PDCA (Plan-Do-Check-Act) management model has gained popularity in nursing, emphasizing continuous quality improvement through its cyclical process. The PDCA model of nursing is based on the concept of quality management

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Table 1. Comparison of baseline information between patients of both groups

| Baseline date | | Control group (n=56) | PDCA group (n=56) | t/ χ^2 | P |
|--------------------------|-------------------|----------------------|-------------------|-------------|-------|
| Age (years) | | 4.68 ± 0.89 | 4.47 ± 0.83 | 1.291 | 0.199 |
| Gender | Male | 23 (41.07) | 28 (50.00) | 0.900 | 0.343 |
| | Female | 33 (58.93) | 28 (50.00) | | |
| Course of disease (d) | | 6.58 ± 1.36 | 6.89 ± 1.46 | -0.941 | 0.349 |
| BMI (kg/m ²) | | 17.31 ± 2.68 | 16.95 ± 2.56 | 0.727 | 0.469 |
| Degree of illness | Mild | 23 (41.07) | 25 (44.64) | -0.037 | 0.970 |
| | Moderate | 16 (28.57) | 12 (21.43) | | |
| | Severe | 17 (30.36) | 19 (33.93) | | |
| Arterial blood gas | PaO ₂ | 76.12 ± 4.26 | 75.13 ± 4.34 | 1.218 | 0.225 |
| | PaCO ₂ | 47.52 ± 3.33 | 46.81 ± 3.16 | 1.157 | 0.250 |
| | SaO ₂ | 83.12 ± 4.05 | 84.11 ± 4.16 | -1.276 | 0.205 |
| Lung function | FVC% | 78.46 ± 11.35 | 76.24 ± 11.68 | 1.020 | 0.310 |
| | FEV1% | 75.62 ± 11.29 | 76.58 ± 11.72 | -0.441 | 0.660 |
| | PFE% | 72.12 ± 11.25 | 75.08 ± 10.26 | -1.455 | 0.149 |

Note: MMP: Mycoplasma pneumonia; PDCA: Plan-Do-Check-Act; BMI: Body mass index; FVC: Forced vital capacity; FEV1: Forced expiratory volume in one second; PEF: Peak expiratory flow.

that emphasizes a continuous cycle of planning, implementing, checking and acting, enabling the nursing team to achieve continuous quality improvement [7, 8]. This model encourages evidence-based practice, ensuring that nursing decisions are scientific and effective [9]. Meanwhile, it also promotes teamwork, prompting caregivers to collaborate in quality improvement efforts, thereby enhancing synergistic effectiveness [10, 11]. By quickly identifying and solving problems in each management cycle, the PDCA model allows for timely adjustments to the nursing process, preserving effective nursing practices, and improving patient care quality continuously [12, 13]. This approach is more humanized and individualized than traditional nursing care. As an innovation in clinical nursing, the PDCA nursing model promotes the continuous improvement of nursing care quality. In this study, we aim to investigate its role in improving the lung function and recovery speed of children with MMP.

Materials and methods

Selection of study subjects

Clinical data of 112 children with MMP who were treated in Hangzhou Ninth People's Hospital from September 2020 to December 2022 were retrospectively analyzed. Based on different nursing interventions, the patients were divided into a control group (56 cases, routine care) and a PDCA group (56 cases,

PDCA care). The general data of the two groups are shown in **Table 1**. The study was conducted in accordance with the Declaration of Helsinki and was approved by the institutional review board of Hangzhou Ninth People's Hospital.

Inclusion criteria: 1. Diagnosed with MMP according to the *Expert Consensus on Laboratory Diagnostic Norms and Clinical Practice of Mycoplasma pneumoniae Infection in Chinese Children (2019)* [14]; 2. Aged 3-6 years old; 3. Good treatment compliance.

Exclusion criteria: 1. Presence of pulmonary diseases such as tuberculosis; 2. Presence of autoimmune diseases; 3. Presence of malignant tumors; 4. Presence of severe liver and kidney dysfunction.

Routine nursing care

Nurses focus on monitoring the vital signs of children and providing daily care, which includes oxygen therapy, health education, position management, drug management, and respiratory care. In addition, nurses should conduct health education and guide the families to promote the children's recovery.

PDCA cycle of care

Planning

The nursing staff identified key challenges and pitfalls in the care of children with MMP through

a thorough literature review [15-17] and previous nursing experience. A. Insufficient nursing education and poor parental co-operation: These factors can negatively impact treatment compliance and exacerbate children's emotional distress. B. Lack of theoretical understanding regarding nutritional: Uncertainty about the timing, method, and components of nutritional support can adversely affect children's nutritional status and immune function. C. Inadequate respiratory tract management: This can increase respiratory burden, negatively affecting blood gases and lung function. D. Failure to implement necessary isolation measures: This oversight may lead to nosocomial infections. E. Poor monitoring and prevention of complications: Ineffective management of complications can hinder the recovery process in children. Nursing staff developed comprehensive plans and programs to improve the quality of care and prognosis of children with MMP in response to the above issues.

Do

Disease education: Close collaboration between parents and the medical team is the key to effective treatment of children with MMP. Various educational methods, including PPT, video animation, lectures, and information boards, were employed to inform families about the clinical manifestations, treatment plans, and the progression of the disease, aiming to improve parents' understanding of MMP, and enhance parental adherence to the treatment [18]. Additionally, nursing staff focused on managing emotional well-being of children and their families by providing timely emotional counseling and communication to help maintain a good psychological state.

Respiratory management: To help reduce the respiratory burden, children were positioned in a semi-sitting posture, and moderate activity was recommended to avoid prolonged recumbency, which is beneficial for gas exchange and preventing pulmonary comorbidities [19]. Besides, adequate oxygen supply was ensured, with the appropriate oxygen therapy device selected based on medical advice. Continuous monitoring of arterial blood gas analysis and other indicators was conducted to adjust the oxygen therapy level and maintain oxygen saturation. In addition, children were encouraged to

drink plenty of fluids to keep the airways moist, aiding in the dilution and clearance of secretions. When needed, humidifiers could be used to increase air humidity, especially in dry environments. Finally, programs such as back patting, medical vibration for expectoration, postural drainage, respiratory control methods, and nebulized inhalation were implemented to facilitate secretion clearance and improve respiratory function [20].

Nutritional intake care: The priority was to focus on maintaining adequate fluid intake in children with MMP, especially in cases of fever and vomiting, to prevent dehydration. Children were encouraged to drink plenty of fluids, such as fruit juices, clear soups, and oral rehydration solutions, which are easily absorbed. Their weight was closely monitored, with timely adjustments to the fluid management program to ensure proper fluid balance. In addition, the daily caloric needs of each child were assessed individually, taking into account their age, weight, and activity level, with focus on high-quality protein intake. Meanwhile, adequate vitamins and minerals were provided, especially vitamin C, vitamin D, zinc and iron, which contribute to the functioning of the immune system.

Segregation measures: To maintain environmental hygiene in the wards, regular disinfection of surfaces and objects were emphasized, with particular attention to high-touch areas. Children with different diseases were segregated and standard precautions were implemented, including wearing masks and gloves and providing separate sanitary facilities. Bedding and personal belongings were changed and cleaned regularly to minimize the risk of transmission. Special care was taken with rubbish disposal, using double bagging and delivery to designated rubbish disposal areas.

Complication prevention: 1. Difficulty breathing: To address respiratory distress, the child was positioned appropriately, typically in a semi-sitting posture, to reduce respiratory burden. Oxygen therapy was applied to maintain an adequate oxygen supply, with oxygen flow adjusted to maintain appropriate oxygen saturation. Regular monitoring of respiratory rate, depth and the use of assistive respiratory muscles is essential for assessing the severity of

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respiratory distress. 2. Pleural effusion: For pleural effusion, the child was closely monitored for signs such as shortness of breath and chest pain. Healthcare professionals promptly arranged a chest X-ray or ultrasound to clarify the cause and extent of the effusion. Thoracentesis or other appropriate treatments were performed under a doctor's guidance to alleviate the breathing discomfort caused by the effusion. 3. Nausea/vomiting: To prevent nausea and vomiting, a light diet was adopted and children were offered small, frequent meals to avoid irritating the gastric mucosa. Keeping the child in a comfortable position, such as lying on the left side, could help to reduce the possibility of gastric reflux. Ensuring the child was adequately hydrated, either by taking small sips of fluid or considering medication to relieve vomiting sensations. 4. Chest tightness/palpitations: When a child developed chest tightness and palpitations, the heart rate and rhythm as well as blood pressure were monitored in time and regularly. Ensure that the child is lying comfortably and oxygen therapy is used to increase blood oxygen levels. Use of anti-arrhythmic drugs or other related treatments as advised by the doctor to relieve palpitations and chest tightness. 5. Hematuria/proteinuria: Child's renal function was closely assessed to manage hematuria/proteinuria, and the child's water-electrolyte balance was maintained to prevent dehydration. Close monitoring of the child's urine output and urine status to detect and manage renal function abnormalities in a timely manner.

Check and action

The implementation of the plan was reviewed weekly, with any issues promptly documented. Regular discussions were organized with members of the Nursing Research Group to propose solutions and practice them in a timely manner to improve the quality of care in the next cycle.

Blood gas analysis and pulmonary function tests

Before and one week after care intervention, PaO₂, PaCO₂ and SaO₂ were measured by a blood gas analyzer (Siemens RAPIDPoint 500), and forced vital capacity (FVC), forced expiratory volume in one second (FEV₁), and peak

expiratory flow (PEF) were measured using a pulmonary function tester.

Detection of inflammation levels

Before and one week after care intervention, 5 mL of venous blood was collected from the children, and the supernatant was centrifuged to detect the levels of interleukin-6 (IL-6, CB10373-Hu), C-reactive protein (CRP, CB10116-Hu) and tumor necrosis factor-alpha (TNF- α , CB11762-Hu) using ELISA. All reagents used were purchased from Shanghai Keaibo Biotechnology Co., Ltd.

Assessment of clinical outcomes

The clinical outcomes of the children were assessed by observing and recording the time to temperature recovery, cough improvement, asthma resolution, disappearance of lung rales, and the length of hospital stay.

Complications

The occurrence of complications during treatment was counted in both groups, including dyspnea, pleural effusion, nausea/vomiting, chest tightness/palpitations, and hematuria/proteinuria.

Satisfaction assessment

A self-designed satisfaction scale was used to evaluate both the quality of care and the level of care management. Quality of care was evaluated based on patient satisfaction with primary care, service attitude, health education, psychological intervention, and professional competence. Meanwhile, the level of care management was assessed in terms of ward management, medical environment, sterilization and isolation, emergency care, and handover management. Each indicator was assessed by the child's family using a 10-point scale (1-10), with higher scores indicating greater satisfaction.

Statistical analysis

Data were analyzed using SPSS 22.0 and GraphPad Prism7. Categorical variables were expressed as n (%) and tested using the χ^2 test. Continuous variables that conformed to a nor-

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

| Group | Case | PaO ₂ (mmHg) | | PaCO ₂ (mmHg) | | SaO ₂ (%) | |
|---------------|------|-------------------------|---------------|--------------------------|---------------|----------------------|---------------|
| | | Pre-care | Post-care | Pre-care | Post-care | Pre-care | Post-care |
| Control group | 56 | 76.12 ± 4.26 | 89.93 ± 4.13* | 47.52 ± 3.33 | 43.48 ± 2.12* | 83.12 ± 4.05 | 89.25 ± 4.08* |
| PDCA group | 56 | 75.13 ± 4.34 | 94.49 ± 4.70* | 46.81 ± 3.16 | 40.16 ± 2.18* | 84.11 ± 4.16 | 93.31 ± 4.13* |
| t | | 1.218 | -5.454 | 1.157 | 8.170 | -1.276 | -5.233 |
| P | | 0.225 | < 0.001 | 0.250 | < 0.001 | 0.205 | < 0.001 |

Note: PDCA: Plan-Do-Check-Act. Compared with before care, *P < 0.05.

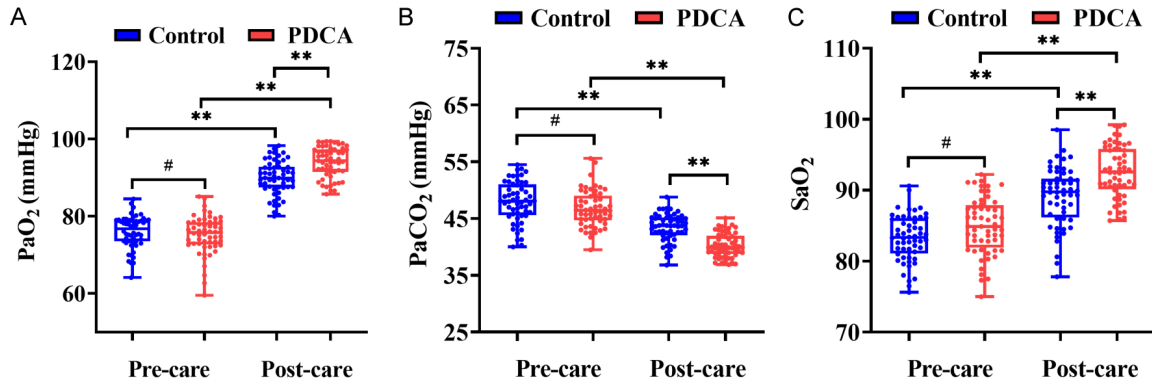


Figure 1. Comparison of arterial blood gas in terms of PaO₂ (A), PaCO₂ (B) and SaO₂ (C) between the two groups. #P > 0.05, **P < 0.01. PDCA: Plan-Do-Check-Act.

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

| Group | Case | FVC (%) | | FEV1 (%) | | PEF (%) | |
|---------------|------|---------------|----------------|---------------|----------------|---------------|----------------|
| | | Pre-care | Post-care | Pre-care | Post-care | Pre-care | Post-care |
| Control group | 56 | 78.46 ± 11.35 | 84.95 ± 13.14* | 75.62 ± 11.29 | 87.96 ± 14.11* | 72.12 ± 11.25 | 81.25 ± 13.68* |
| PDCA group | 56 | 76.24 ± 11.68 | 91.52 ± 14.73* | 76.58 ± 11.72 | 93.52 ± 14.68* | 75.08 ± 10.26 | 89.61 ± 13.83* |
| t | | 1.020 | -2.491 | -0.441 | -2.043 | -1.455 | -3.216 |
| P | | 0.310 | 0.014 | 0.660 | 0.043 | 0.149 | 0.002 |

Note: PDCA: Plan-Do-Check-Act; FVC: Forced vital capacity; FEV1: Forced expiratory volume in one second; PEF: Peak expiratory flow. Compared with before care, *P < 0.05.

mal distribution were presented as mean ± standard deviation (SD), and the two-tailed student's *t*-test was applied to assess the differences between two groups. Statistical significance was indicated by a *P*-value of less than 0.05.

Results

PDCA nursing better improved children's arterial blood gas

After nursing care, arterial blood gas results were markedly improved in both groups compared to the pre-care levels, with a significant

increase in PaO₂ and SaO₂, and a marked decrease in PaCO₂. Notably, the PDCA group demonstrated significantly higher PaO₂ and SaO₂ levels and lower PaCO₂ level than the control group (Table 2; Figure 1).

PDCA nursing better improved children's lung function

Both groups demonstrated varying degrees of improvement in lung function after nursing care, as indicated by increases in FVC%, FEV1%, and PEF%. However, the PDCA care group showed more substantial improvements in these metrics (Table 3; Figure 2).

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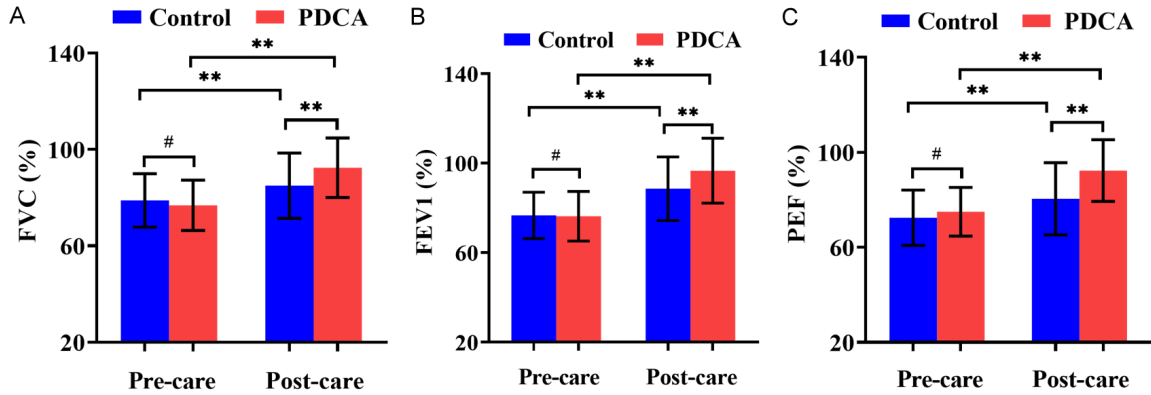


Figure 2. Comparison of lung function in terms of FVC% (A), FEV1% (B), and PFE% (C) between the two groups. # $P > 0.05$, ** $P < 0.01$. PDCA: Plan-Do-Check-Act; FVC: Forced vital capacity; FEV1: Forced expiratory volume in one second; PEF: Peak expiratory flow.

Table 4. Comparison of inflammation levels between the two groups ($\bar{x} \pm s$)

| Group | Case | IL-6 (ng/L) | | CRP (mg/L) | | TNF- α (ng/L) | |
|---------------|------|------------------|-------------------|------------------|-------------------|----------------------|-------------------|
| | | Pre-care | Post-care | Pre-care | Post-care | Pre-care | Post-care |
| Control group | 56 | 45.32 \pm 6.04 | 25.65 \pm 4.36* | 26.24 \pm 3.64 | 11.23 \pm 2.04* | 40.13 \pm 5.76 | 34.43 \pm 3.57* |
| PDCA group | 56 | 46.23 \pm 6.59 | 18.98 \pm 3.35* | 25.64 \pm 3.56 | 7.89 \pm 1.43* | 39.87 \pm 5.68 | 20.13 \pm 2.65* |
| t | | -0.821 | 9.780 | 0.950 | 10.809 | 0.259 | 25.931 |
| P | | 0.413 | < 0.001 | 0.344 | < 0.001 | 0.796 | < 0.001 |

Note: PDCA: Plan-Do-Check-Act; IL-6: interleukin-6; CRP: C-reactive protein; TNF- α : tumor necrosis factor-alpha. Compared with before care, * $P < 0.05$.

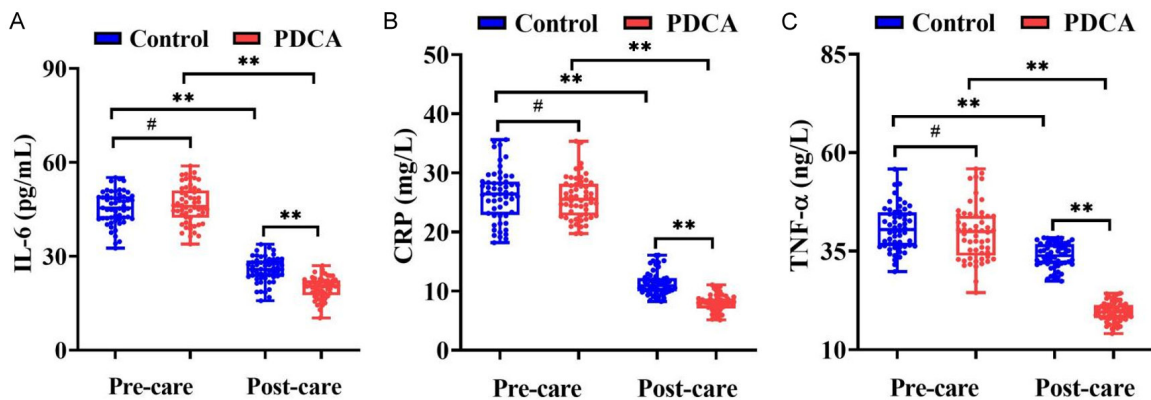


Figure 3. Comparison of inflammation levels in terms of IL-6 (A), CRP (B), and TNF- α (C) between the two groups. # $P > 0.05$, ** $P < 0.01$. PDCA: Plan-Do-Check-Act; IL-6: interleukin-6; CRP: C-reactive protein; TNF- α : tumor necrosis factor-alpha.

PDCA care better controlled inflammation levels in children

Inflammation levels were markedly reduced in both groups compared to pre-care levels, as evidenced by decreases in IL-6, CRP, and TNF- α levels. The reduction was especially notable in the PDCA group (Table 4; Figure 3).

PDCA care better promoted the rapid recovery of children

The outcome measures, including time to temperature recovery, cough improvement, asthma resolution, lung rales disappearance, and hospital stay, indicated that children who received PDCA care recovered more quickly. The reduc-

Table 5. Comparison of clinical outcomes between the two groups ($\bar{x} \pm s, d$)

| Group | Case | Time to temperature normalization | Time to cough improvement | Time to asthma resolution | Time to lung rate disappearance | Hospitalization time |
|---------------|------|-----------------------------------|---------------------------|---------------------------|---------------------------------|----------------------|
| Control group | 56 | 4.12+0.84 | 6.87 ± 1.35 | 5.41 ± 1.22 | 6.54+1.42 | 8.31+1.45 |
| PDCA group | 56 | 3.79+0.78 | 4.53 ± 1.24 | 4.78 ± 1.17 | 5.78+1.34 | 7.65+1.34 |
| t | | 2.154 | 9.553 | 2.789 | 2.913 | 2.502 |
| P | | 0.033 | <0.001 | 0.006 | 0.004 | 0.014 |

Note: PDCA: Plan-Do-Check-Act.

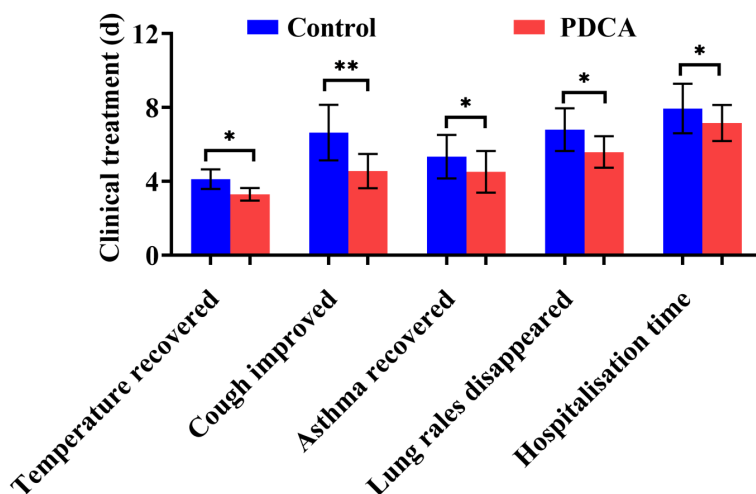


Figure 4. Comparison of clinical treatment. * $P < 0.05$, ** $P < 0.01$. PDCA: Plan-Do-Check-Act.

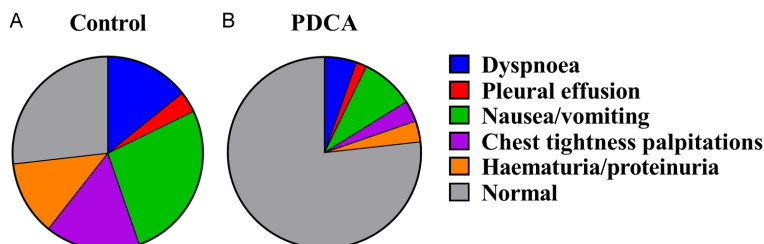


Figure 5. Major complications in the two groups. PDCA: Plan-Do-Check-Act.

tion in recovery time was more pronounced in the PDCA group, allowing for earlier hospital discharge (Table 5; Figure 4). Therefore, PDCA care facilitates faster recovery in children.

PDCA care was effective in reducing complications

Effective prevention of extrapulmonary complications during MMP therapy is crucial. We found that the primary complications included dyspnea, pleural effusion, nausea/vomiting, chest tightness/palpitations, and hematuria/

proteinuria. The incidence of extrapulmonary complications was markedly lower in children who received the PDCA care (55.36% vs. 16.07%) (Figure 5).

The PDCA care model better improved family satisfaction

Families of children who received PDCA care rated the quality of care markedly higher in several areas, including primary care, service attitude, health education, psychological intervention, and professional competence. Similar results were found in the assessment of the ward management, medical environment, sterilization and isolation, emergency care, and handover management (Figure 6). These results suggested that PDCA nursing could effectively improve nursing quality and patient satisfaction.

Discussion

In the treatment of children with MMP, nursing staff play a crucial role in monitoring and maintaining the vital signs, implementing medical prescriptions, providing respiratory support, managing positions, and overseeing diet and nutrition [21, 22]. These factors directly influence their speed of recovery and therapeutic outcomes. However, the unique needs of pediatric patients necessitate that nursing staff possess substantial experience in pediatric care. In practice, occasional shortages in manpower and limited professional experience can adversely affect the quality of care provided

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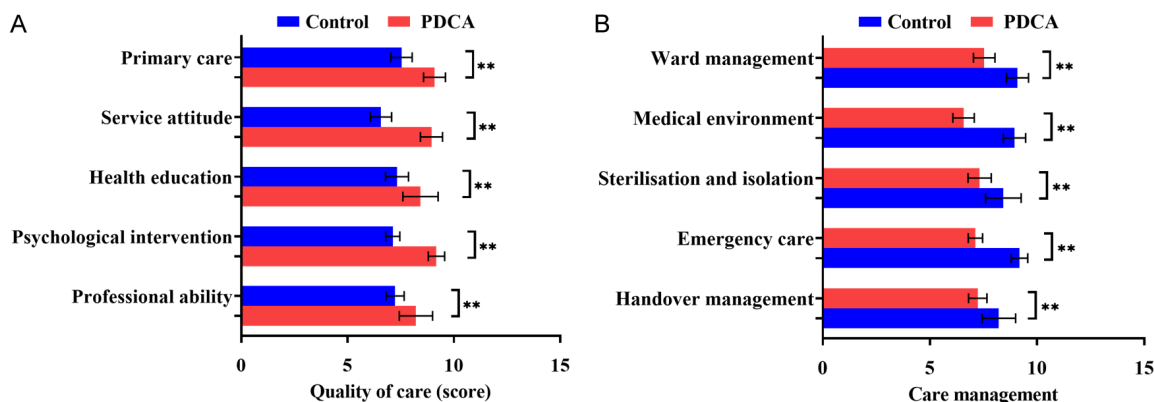


Figure 6. Comparison of family satisfaction with quality of care (A) and care management (B) between the two groups. ** $P < 0.01$. PDCA: Plan-Do-Check-Act.

[23]. Therefore, a scientific and systematic nursing management model is urgently needed to improve the science and effectiveness of nursing care.

The PDCA nursing model offers a structured approach to managing the nursing process through four phases: planning, execution, checking, and action. In the planning phase, nursing staff develop individualized care plans based on the assessment of children with MMP, setting clear nursing goals such as improving lung function and increasing blood oxygen levels. During the execution phase, nursing staff implement personalized nursing measures, including positional management, oxygen therapy adjustment, and airway care. The checking and action phases involve data-driven monitoring and evaluation to assess the effectiveness of nursing measures, identify existing problems, and promptly adjust care plans and optimize nursing strategies in response to identified issues. Characterized by systematic, personalized, data-driven approach and focus on continuous improvement, the PDCA cycle nursing model effectively addresses current deficiencies in nursing care, leading to the continuous optimization of nursing measures and improvement in nursing quality for children with MMP.

Improving blood gas levels and lung function in children with MMP is crucial for their recovery. Research indicates that PDCA care significantly enhances these parameters. The PDCA nursing model improves airway maintenance through various measures, such as adopting a semi-

sitting position, which alleviates respiratory burdens and improves lung ventilation [24]. Additionally, real-time monitoring adopted by the PDCA model allows for timely adjustments in oxygen therapy to ensure adequate oxygen supply, promoting effective gas exchange while alleviating hypoxia symptoms [25]. In addition, the real-time checking and action phases of the PDCA model further enhances respiratory care. Interventions like back patting and medical vibration sputum expectoration facilitate respiratory secretion clearance and prevent pathogen retention in the lungs [26]. These interventions effectively mitigate lung inflammation, improve alveolar congestion, and reduce respiratory tract wall edema, thereby enhancing children's ventilation and gas diffusion capabilities. Hence, the PDCA nursing model substantially enhances blood gas levels and lung function in children with MMP.

Inflammatory factor levels are key indicators of immune-inflammatory responses and are crucial in exacerbating MMP and potentially causing extrapulmonary complications. Pro-inflammatory factors such as IL-6 and TNF- α , jointly regulate the body's immune response and promote the occurrence of the inflammatory response [27, 28]. Conversely, CRP levels reflect tissue and intracellular inflammation, effectively assessing MMP progression and recovery [29]. Research findings suggest that PDCA care is more effective in reducing the levels of these indicators in children with MMP. This is attributed to several factors. PDCA care can more effectively improve ventilation function and oxygenation capacity, thereby reduc-

ing tissue hypoxia and inhibiting the release of inflammatory mediators such as IL-6 and TNF- α [30, 31]. In addition, enhanced ventilation supports airway patency, facilitating the clearance of pathogens and inflammatory mediators, thus mitigating the inflammatory response [32, 33]. Moreover, the PDCA care improves nutritional support by providing sufficient calories and high-quality protein, which enhances immune function and further suppress lung inflammation [9]. Therefore, the PDCA nursing model offers a more comprehensive and systematic approach to managing the children's conditions, leading to better control of inflammation levels. Benefit from better pulmonary recovery and inflammatory factor control, children in the PDCA group recovered faster, evidenced by reduced time of temperature recovery, cough improvement, asthma resolution, lung rales disappearance, and shorter hospital stay.

Preventing MMP-related complications is crucial for promoting children's recovery and reducing treatment difficulty. We find that PDCA care better inhibits the occurrence of intrapulmonary and extrapulmonary related complications. This is achieved through personalized treatment plans, real-time monitoring, and prompt adjustments to treatment as needed [34]. Meanwhile, measures such as positional management, oxygen therapy, and physiotherapy help maintain children's airway patency, improve lung function, and prevent respiratory complications [23]. Additionally, healthcare teams effectively identify early signs of complications through full participation and effective communication, promptly adjusting treatment plans and reducing complication risks [35]. Moreover, personalized nutritional support further enhances the children's immune function, thereby preventing extrapulmonary complications such as infections. Therefore, the PDCA model enables comprehensive and effective management of children, reducing complications and enhancing treatment success rate.

With regard to the satisfaction of children's families, the PDCA model of care has made the care process more scientific and efficient. The continuous cycle of planning, implementation, checking, and acting, supported by systematic quality management, contributes to this improvement [12]. Meanwhile, the nature of real-time monitoring and adjustment makes

care more flexible and responsive to patient needs, thereby enhancing the trust of patients and families in medical care [24]. Moreover, encouraging full participation and close communication fosters a collaborative healthcare environment and improves information accuracy. Consequently, families of children receiving PDCA care reported significantly higher satisfaction with the entire healthcare team.

Conclusion

In conclusion, the PDCA cycle of care effectively improves nursing practices through its continuous management cycle. This approach significantly improves lung function and blood gas level of children with MMP, reduces inflammation, and decreases the incidence of complications. Therefore, the children in the PDCA group recovered faster and had a better prognosis. Additionally, the PDCA cycle nursing effectively improves the quality of nursing care and management, enhances family satisfaction, and fosters a more harmonious doctor-patient relationship.

Disclosure of conflict of interest

None.

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