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"Effectiveness of Planned Nursing Interventions on Health Status Among Children with Bronchopneumonia Admitted at Pravara Rural Hospital Loni Maharashtra."

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Abstract
Background: *Pediatric respiratory illnesses remain a significant cause of morbidity and mortality globally, with pneumonia accounting for a substantial proportion of deaths in children fewer than five years of age. There is a growing need for effective, child-friendly, non-pharmacological interventions to complement standard medical treatment.*
Materials and Methods: *A quasi-experimental pre–post-test study was conducted among 250 children aged 3 to 5 years diagnosed with bronchopneumonia in the pediatric ward of Dr. Vitthalrao Vikhe Patil Pravara Rural Hospital. Participants were equally divided into two groups: Group I (control) received standard care, and Group II (intervention) received structured respiratory hygiene techniques—including breathing exercises, balloon blowing, and the "Candle and Flower" activity—administered in addition to standard care. Interventions were delivered using a standardized protocol.*
Results: *Significant improvements were observed in both groups, with greater changes in the intervention group. Respiratory rate declined from 44.62 to 31.76 in Group II and from 42.36 to 30.70 in Group I. Oxygen saturation (SpO_2) improved from 95.46 to 98.46 in Group II and from 95.58 to 97.88 in Group I. Group II showed significantly better airway clearance by day 3 ($p = 0.018$) and day 5 ($p < 0.0001$). The average hospital stay was shorter in Group II (7.30 ± 1.12 days) compared to Group I (9.89 ± 0.82 days, $p = 0.0001$). Group II also experienced fewer complications and better clinical outcomes.* ***Conclusion:*** *Respiratory hygiene interventions are effective, acceptable, and easy- to-implement adjuncts that improve clinical outcomes in children with bronchopneumonia.*
Keywords: *Bronchopneumonia, Pediatric, Nursing Intervention, Breathing Exercise.*

INTRODUCTION

Pediatric respiratory diseases remain a major cause of morbidity in both developing and developed countries.[1] Globally, pneumonia is one of the leading causes of death among children under five years of age, accounting for approximately 14% of all under-five deaths and claiming the lives of around 740,180 children in 2019.[2] Oxygen and glucose are essential for the functioning of every cell and organ system in the body. Breathing serves as a vital link between the body and the mind, and both rely on adequate oxygenation for optimal performance. Children are more vulnerable to respiratory infections than adults due to their underdeveloped immune systems and anatomical differences, making them less immunocompetent.[3] As a result, respiratory infections are common and pose a serious threat to children's health, often leading to impaired daily activities, hospitalization, delayed growth and development, and in severe cases, death ,[4]

Pneumonia adversely affects the lungs by causing an overproduction of mucus and other fluids, which obstruct normal breathing and disrupt gas exchange. If not managed properly, pneumonia can lead to long-term complications such as permanent lung damage and respiratory failure. In addition to standard treatment, planned nursing interventions—such as respiratory hygiene techniques including balloon-blowing therapy and "blow out the candle" activities—can serve as effective adjuncts to improve respiratory outcomes in children. These play-based methods engage children actively and target the intercostal muscles responsible for expanding the diaphragm and ribcage. Such activities enhance lung function by increasing oxygen intake, promoting gas exchange, and facilitating the removal of carbon dioxide.[5] Regular practice of these exercises can gradually improve lung capacity and overall respiratory health. India, with the largest child population in the world, requires on going and focused efforts to improve child health through comprehensive interventions in health care, education, and social welfare.[6]

MATERIAL & METHODS:

Children with bronchopneumonia were the focus of present quasi-experimental pre-post-test study conducted in the pediatric ward of Dr. Vitthalrao Vikhe Patil Pravara Rural Hospital (DVVPRH). Parents or legal guardians granted their informed consent, and ethical approval was acquired upfront. A total of 250 children were involved in the study, 125 of them being distributed between the control (Group I) and experimental (Group II). Participants whom had a confirmed diagnosis of pneumonia and were between the ages of three and five were enrolled. Children who were recalcitrant or had severe neurological problems weren't eligible to participate. Purposive sampling was used to select participants. On the first day of the study, the investigator built a good rapport with the children and their guardians. After clearly explaining the purpose and significance of the research, written informed consent was obtained. Baseline clinical parameters were recorded prior to initiating the intervention. Following the pre-test assessment, the investigator implemented a set of predetermined pilot tested planned nursing interventions as an adjuvant to routine therapy, which included the various playful activities.

As part of the adjuvant nursing interventions provided alongside standard care for children with bronchopneumonia, a combination of respiratory hygiene techniques was implemented to enhance lung function and support recovery. The intervention began with diaphragmatic (abdominal) breathing exercises, designed to reduce reliance on accessory muscles. Children were positioned either supine or semi-recumbent and guided to take deep breaths through the nose, followed by slow exhalation through pursed lips. These sessions were repeated multiple times a day to ensure consistent practice and effectiveness.

Balloon blowing therapy was also introduced, where children were given colorful, pre- stretched balloons to inflate twice daily, maintaining a 6 to 8-hour interval between sessions. This activity helped improve lung expansion in a fun and engaging way. In addition, the candle and flower activity incorporated imaginative play to promote deep breathing. Children were encouraged to pretend to hold a flower in one hand and a candle in the other—taking a deep breath to "smell the flower" and exhaling forcefully to "blow out the candle," making the exercise both therapeutic and enjoyable.

To assist with mucus clearance, postural drainage and chest percussion were performed. Children were positioned based on the specific lung lobe involved, using positions such as Trendelenburg or prone/supine variations. Chest percussion using cupped hands was applied to mobilize respiratory secretions effectively. Nebulization therapy was administered as per the physician's instructions to facilitate bronchodilation and loosen mucus prior to engaging in the respiratory exercises. These supportive nursing measures aimed to enhance the effectiveness of medical treatment and promote faster recovery in children with bronchopneumonia.

Each respiratory hygiene session was conducted for approximately 30 minutes and administered twice daily. The intervention was continued for a minimum of five days. The effectiveness of the intervention was evaluated using several outcome measures. These included improvements in pulmonary function, indicated by a reduction in respiratory rate, pulse rate, and blood pressure, along with an increase in oxygen saturation (SpO_2). Additional indicators such as enhanced airway clearance, reduced length of hospital stay, and overall treatment outcomes were also assessed to determine the effectiveness of the intervention.

Statistical Analysis

Prior to analysis, the gathered questionnaires were carefully examined for internal consistency and completeness. IBM SPSS Statistics version 21 was used for statistical analysis once all responses were coded and imported into Microsoft Excel. The Shapiro-Wilk test was used to evaluate the normality of quantitative data. The mean as well as the standard deviation (SD) were used to denote variables having a normal distribution. Respiratory parameters were measured at three time points: baseline, day 5, and at the time of discharge. For statistical comparisons, Fisher's Exact Test, Chi-Square Test, and Unpaired t-test were applied as appropriate. A p-value of less than 0.05 was considered indicative of statistical significance.

RESULTS

In the present study, a total of 250 children aged between 3 and 5 years and diagnosed with bronchopneumonia were enrolled, with 125 participants assigned to each group. Of these, 190 children were in the 3–4-year age group, while 60 were in the 4–5-year age group. The difference in age distribution between the experimental and control groups was not statistically significant ($p = 0.29$) (Table 1). Among

the participants, 110 were male and 140 were female, with no statistically significant difference in gender distribution between the two groups (p = 0.37) additionally, 187 children were from rural areas, and 118 respondents had completed their primary education; however, there was no significant difference between the groups in terms of residence or educational background. Of the 250 bronchopneumonia patients, 187 and 63 were mild and moderate patients. Graph 01

Table 01: Socio-demographic distribution as per treatment group				
Sr. No.	Age group	Group I	Group II	P
1.	≥ 3 yrs. to < 4 yrs.	99	91	0.29#
2.	≥ 4 yrs. to 5 yrs.	26	34	
Sr. No.	Gender	Group I	Group II	0.37#
1.	Male	59	51	
2.	Female	66	74	
Sr. No.	Residence	Group I	Group II	0.14#
1.	Rural	88	99	
2.	Urban	37	26	
Sr. No.	Informant's Education	Group I	Group II	0.06#
1.	Illiterate	09	07	
2.	Primary	57	61	
3.	Secondary (SSC)	33	42	
4.	Higher Secondary (HSC)	25	11	
5.	Graduates	01	04	

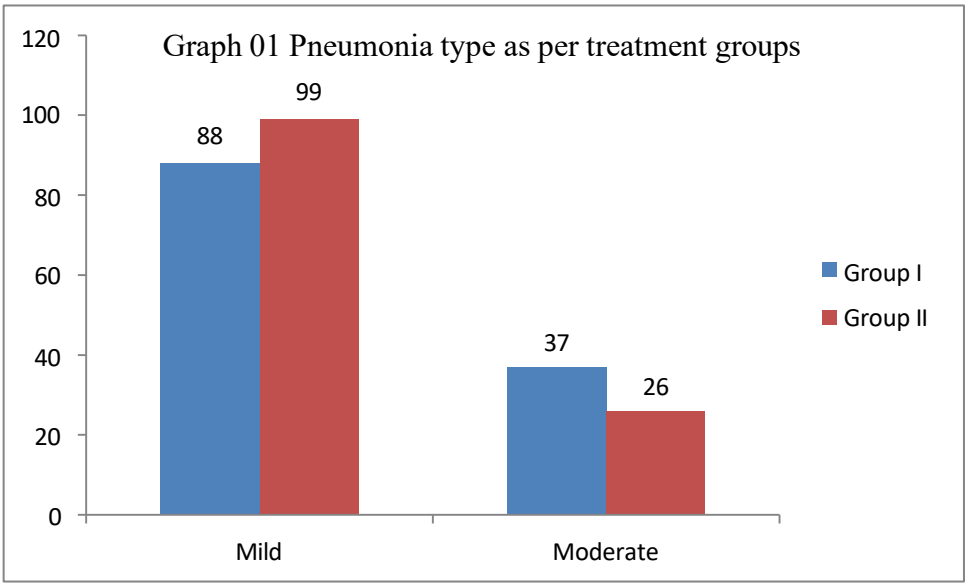


Table 02 presents the distribution of participants based on birth history, breastfeeding practices, and immunization status. Among the children, 41 were born preterm, 190 were full-term, and 19 were post-term. The difference in gestational age between the two groups was not statistically significant (p = 0.6). In terms of birth weight, 56 children had low birth weight, while 194 had normal or above-normal birth weight, with no significant difference observed between the groups p=0.48). Birth order analysis revealed that most children were either second-born (103) or third-born (105). Exclusive breastfeeding was reported in 145 children, and in 149 cases, weaning was initiated after six months. Immunization was found to be complete for age in 230 children. Statistically significant differences were noted in birth order (p = 0.04), exclusive breastfeeding (p = 0.0001), and age of weaning (p = 0.0001), while immunization status did not show a significant difference between the groups (p = 0.10).

Table 02: Distribution of birth, breastfeeding and immunisation history				
Sr. No.	Gestational Age	Group I (%)	Group II (%)	P
1.	Pre term	19	22	0.64#
2.	Term	98	92	
3.	Post term	08	11	
Sr. No.	Birth weight	Group I (%)	Group II (%)	0.48#
1.	< 2.5 Kg.	29	27	
2.	≥ 2.5 Kg to 03 Kg.	82	89	
3.	≥ 03 Kg.	14	09	
Sr. No.	Birth order	Group I	Group II	0.04*
1.	1st Born	10	19	
2.	2nd Born	46	57	
3.	3rd Born	60	45	
4.	Above 3rd	09	04	
Sr. No.	Exclusive breast feeding	Group I (%)	Group II (%)	0.0001*
1.	Yes	56	89	
2.	No	69	36	
Sr. No.	Age of weaning	Group I (%)	Group II (%)	0.0001*
1.	< less than 06 months	77	24	
2.	≥ more than 06 months	48	101	
Sr. No.	Immunisation status	Group I (%)	Group II (%)	0.10#
1.	Completed for age	111	119	
2.	Incomplete for age	14	06	
	Total	125	125	

*Significant, #:Non-significant

Table 03 provides a comparison of clinical parameters between the two groups. In Group I, the mean respiratory rate on admission was 42.36 ± 10.79, which declined to 39.21 ± 9.35 on the fifth day and further decreased to 30.70 ± 5.49 at the time of discharge. This reduction was statistically significant ($p = 0.0001$). Similarly, in Group II, the mean respiratory rate at admission was 44.62 ± 9.11, which dropped to 37.23 ± 8.15 by the fifth day and further to 31.76 ± 5.10 upon discharge, also showing a statistically significant decrease over time ($p = 0.0001$). Regarding oxygen saturation (SpO_2), Group I had a mean value of 95.58 ± 1.71 at admission, which increased to 96.57 ± 1.71 on the fifth day and further to 97.88 ± 1.46 at discharge. In Group II, the mean SpO_2 at admission was 95.46 ± 1.75, rising to 97.65 ± 1.68 on the fifth day and 98.46 ± 1.10 at discharge. The increase in oxygen saturation over time in both groups was statistically significant ($p = 0.0001$)

The comparison of pulse rate between the two groups also showed a statistically significant reduction over time. In Group I, the mean pulse rate at admission was 108.53 ± 16.73, which decreased to 105.97 ± 14.22 on the fifth day and further to 99.61 ± 11.38 at discharge ($p < 0.0001$). Similarly, in Group II, the mean pulse rate was 109.76 ± 18.29 at admission, reduced to 102.89 ± 13.17 on the fifth day, and dropped further to 97.48 ± 11.98 at discharge, also showing a statistically significant improvement ($p < 0.0001$). Systolic blood pressure (SBP) showed a significant upward trend over time in both groups. In Group I, the mean SBP at admission was 94.38 ± 2.96, which increased to 97.55 ± 1.75 on the fifth day and further rose to 101.29 ± 3.75 at discharge ($p < 0.0001$). Similarly, in Group II, the mean SBP was 95.70 ± 2.95 at admission, increased to 101.23 ± 3.77 on the fifth day, and reached 102.57 ± 4.60 at discharge. This rise in SBP was also statistically significant ($p < 0.0001$).

Diastolic blood pressure (DBP) remained relatively stable throughout the study period in both groups, with no statistically significant changes observed. In Group I, the mean DBP was 76.65 ± 3.26 at admission, 77.02 ± 3.21 on the fifth day, and 76.89 ± 3.34 at discharge ($p = 0.62$). Similarly,

in Group II, the mean DBP was 75.35 ± 3.12 at admission, 75.67 ± 3.04 on the fifth day, and 75.48 ± 3.82 at discharge, also showing no significant difference over time (p = 0.74).

Table 03 Distribution of clinical parameters as per treatment group				
Variable	On admission	5th Day	On Discharge	Repeated ANOVA
RR Group I	42.36 ± 10.79	39.21 ±9.35	30.70 ± 5.49	< 0.0001*
RR Group II	44.62 ± 9.11	37.23 ± 8.15	31.76 ± 5.10	< 0.0001*
SpO2 Group I	95.58 ± 1.71	96.57 ±1.71	97.88 ± 1.46	< 0.0001*
SpO2 Group II	95.46 ± 1.75	97.65 ± 1.68	98.46 ± 1.10	< 0.0001*
PR Group II	108.53 ± 16.73	105.97 ± 14.22	99.61 ± 11.38	< 0.0001*
PR Group II	109.76 ± 18.29	102.89 ± 13.17	97.48 ± 11.98	< 0.0001*
SBP Group I	94.38±2.96	97.55±1.75	101.29±3.75	< 0.0001*
SBP Group II	95.70 ± 2.95	101.23 ± 3.77	102.57 ± 4.60	< 0.0001*
DBP Group I	76.65 ± 3.26	77.02 ± 3.21	76.89 ± 3.34	< 0.62#
DBP Group II	75.35 ± 3.12	75.67 ± 3.04	75.48 ± 3.82	< 0.74#

*Significant, #:Non-significant

Table 4 presents the comparison of airway clearance status on admission, the 3rd day, and the 5th day between the two treatment groups. At admission**,** 66 children (Group I) and 71 children (Group II) showed infective airway clearance, while 59 and 54 children respectively demonstrated effective clearance. The difference between the groups was not statistically significant (p = 0.29). By the 3rd day, infective clearance reduced to 56 in Group I and 37 in Group II, while effective clearance increased to 69 and 88, respectively. This difference was statistically significant (p = 0.018). On the 5th day, only 48 children in Group I and 14 in Group II exhibited infective clearance, whereas effective clearance was noted in 77 (Group I) and 111 (Group II) participants. The improvement in airway clearance was highly significant between the groups (p = 0.0001).

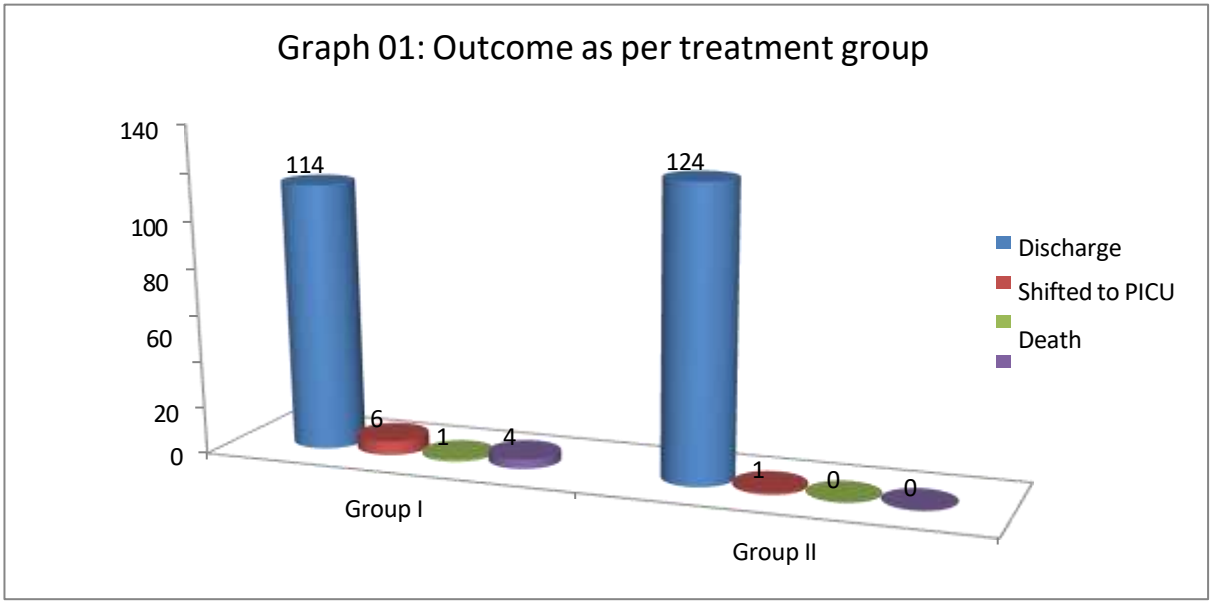
Table 4: Airway clearance on admission, 3rd and 5th day as per treatment groups				
Sr. No.	Airway clearance On Admission	Group I (%)	Group II (%)	P
1.	Infective	66	71	0.29#
2.	Effective	59	54	
Sr. No.	Airway clearance On 3rd day	Group I (%)	Group II (%)	0.018*
1.	Infective	56	37	
2.	Effective	69	88	
Sr. No.	Airway clearance On 5th day	Group I (%)	Group II (%)	0.0001*
1.	Infective	48	14	
2.	Effective	77	111	

*Significant, #:Non-significant

Table 5 presents the comparison of the length of hospital stay between the two groups. The mean duration of hospital stay in Group I was 9.89 ± 0.82 days, while in Group II it was significantly shorter at 7.30 ± 1.12 days. This difference was statistically significant as determined by the unpaired t-test (t = 20.86, df = 248, p = 0.0001), indicating a notable reduction in hospital stay for children in Group II.

Table 5 : Length of hospital stay in days		
Days	Group I	Group II
Mean ± SD	9.89±0.82	7.30±1.12
Unpaired t test 20.86 d.f:248 P:0.0001 Significant		

Graph 01 displays the treatment outcomes of children with bronchopneumonia in both study groups. In Group I, 114 children were successfully discharged, 6 were shifted to the PICU, 1 child unfortunately died, and 4 left against medical advice (DAMA). In contrast, Group II had a more favorable outcome, with 124 children discharged, only 1 shifted to the PICU, and no deaths or DAMA cases reported. These findings suggest that the intervention administered to Group II may have contributed to better clinical outcomes and reduced complications.



DISCUSSION

Childhood pneumonia remains a widespread infectious disease in developing nations and is a major contributor to preventable illness and death among young children. This quasi- experimental study was carried out among 250 children diagnosed with bronchopneumonia to assess the effectiveness of respiratory hygiene interventions in improving their respiratory parameters.

In this study, 250 children aged 3 to 5 years with bronchopneumonia were enrolled, evenly divided into experimental and control groups (125 each). Most participants (190) were aged 3–4 years, and 60 were aged 4–5 years, with no significant age difference between groups ($p = 0.29$). Gender distribution (110 males, 140 females) was also comparable ($p = 0.37$). Additionally, 187 children were from rural areas, and 118 had completed primary education, with no significant group-wise difference. Based on disease severity, 187 children had mild and 63 had moderate bronchopneumonia. The study by Vidhushree D et al. (2024)[7] reported a modest predominance of male children in the sample, with 55.9% males compared to 44.1% females. In same study among children classified as pneumonia by IMNCI (n=173), majority were well-looking (53.2%) and ill looking (41.0%); only 5.8% were seriously-ill- looking. Conversely, 87.7% among those children classified as severe pneumonia by IMNCI were seriously-ill-looking by AIOS score; only10.8% was ill-looking and 1.5% were well- looking. Das SM et al (2018)[5] conducted a study evaluate the effect and comparison of balloon and bubble therapy among the lower respiratory tract infection child. Total 60 children between 3-12 years of age with lower respiratory tract infection were randomized to receive to different therapies. Out of 60 participants 37 and 23 were boys and girls respectively.

In present study among the children, 41 were preterm, 190 full-term, and 19 post-term, with no significant group-wise difference in gestational age ($p = 0.6$). Low birth weight was noted in 56 cases, while 194 had normal or higher birth weight ($p = 0.48$). Most children were second- (103) or third-born (105). Exclusive breastfeeding was reported in 145 children, and weaning after six months in 149. Immunization was complete for age in 230 children. Significant differences were observed in birth order ($p = 0.04$), exclusive breastfeeding ($p = 0.0001$), and age of weaning ($p = 0.0001$), but not in immunization status ($p = 0.10$). In Group I, respiratory rate significantly dropped from 42.36 to 30.70, and in Group II from

44.62 to 31.76 ($p = 0.0001$). Oxygen saturation (SpO_2) improved significantly in both groups—from 95.58 to 97.88 in Group I and 95.46 to 98.46 in Group II ($p = 0.0001$). Pulse rate also showed a significant decline: from 108.53 to 99.61 in Group I and 109.76 to 97.48 in Group II ($p < 0.0001$). Systolic blood

pressure rose significantly in both groups, while diastolic pressure remained stable with no significant change ($p > 0.05$). In the study by Das SM et al. (2018)[5], a significant improvement was observed following balloon therapy. The mean respiratory rate decreased from 29.47 ± 4.47 in the pretest to 19.53 ± 2.32 in the post- test ($p = 0.0001$). Similarly, the mean oxygen saturation improved from 93.77 ± 1.83 to
97.9 ± 1.57 after the intervention, which was also statistically significant ($p = 0.0001$)

In the study by Rafaqat A et al. (2016),[8] balloon therapy led to statistically significant improvements in respiratory parameters. The mean respiratory rate decreased from
27.43 ± 1.98 before treatment to 25.01 ± 1.79 after treatment ($p = 0.0001$). Likewise, oxygen saturation increased from 90.73 ± 2.34 to 94.36 ± 1.71 post-intervention, also showing a significant difference ($p = 0.0001$). In the study by Arunima S et al. (2016)[9], balloon therapy resulted in statistically significant improvements in respiratory parameters. The mean respiratory rate decreased from 23.98 ± 1.40 in the pretest to 23.06 ± 1.68 in the post-test ($p \leq 0.05$). Similarly, the mean oxygen saturation increased from 97.38 ± 3.38 to 98.31 ± 3.98, which was also statistically significant ($p \leq 0.05$).
Present study shows significant improvement in airway clearance in Group II compared to Group I. On admission, there was no notable difference between groups ($p = 0.29$). By day 3, effective clearance was higher in Group II ($p = 0.018$), and by day 5, Group II showed markedly better airway clearance ($p = 0.0001$). Table 5 highlights that the average hospital stay was significantly shorter in Group II (7.30 ± 1.12 days) than in Group I (9.89 ± 0.82 days; $p = 0.0001$). The study by Tiwari et al. (2024)[10] compared the effectiveness of balloon therapy and incentive spirometry in children with lower respiratory tract infections (LRTIs). While both interventions led to improvements in respiratory outcomes, the difference between the two groups was not statistically significant ($p > 0.05$), suggesting that either method can be effectively used in clinical practice. In present study better outcomes was seen in Group II, with 124 discharges, only one PICU transfer, and no deaths or DAMA cases, compared to Group I, which had more complications, including one death and four DAMA cases.

CONCLUSION

The findings of the study indicate that planned nursing interventions are effective in improving the clinical outcomes of children with bronchopneumonia. This effectiveness may be attributed to the fact that these interventions are more acceptable to children, as they resemble routine play activities. Additionally, they are convenient to administer and require minimal skills to implement.

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