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Review Article

Health Economic Evaluation of the Unaccompanied and Family - integrated Care Model for Preterm Infants

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Abstract

Objective: To evaluate the application value of the unaccompanied combined family - based care model for preterm infants from the perspective of health economics, so as to provide empirical evidence for the optimization of clinical nursing, the allocation of medical resources, and the adjustment of medical insurance policies.

Methods: A total of 120 preterm infants were randomly divided into an observation group (60 cases) and a control group (60 cases). The observation group implemented the unaccompanied basic care combined with the phased family - involved care model, while the control group adopted the traditional simple unaccompanied care. Indicators such as direct medical costs during hospitalization, length of hospital stay, readmission rate, and growth and development compliance rate at 3 years old were collected for both groups. Cost - effectiveness ratio and incremental cost - effectiveness ratio were used for economic evaluation, and univariate sensitivity analysis was combined to verify the robustness of the results.

Results: The per capita total hospitalization cost of the observation group was (42,350 ± 5,620) yuan, and the average length of hospital stay was (29.8 ± 5.6) days, both significantly lower than those of the control group [(51,280 ± 6,450) yuan and (36.5 ± 6.2) days, $P < 0.001$]. The growth and development compliance rate at 3 years old in the observation group was 91.6%, higher than 73.3% in the control group. The cost - effectiveness ratio of the observation group was better than that of the control group, which was a dominant scheme with lower cost and better effect. Sensitivity analysis confirmed the reliability of the results.

Conclusion: The unaccompanied combined family - based care model for preterm infants has significant cost - effectiveness advantages, can achieve dual optimization of clinical efficacy and medical economy, and is suitable for promotion and application in the field of neonatal intensive care.

Keywords: Preterm infants, Unaccompanied care, Family - based care, Health economic evaluation, Cost - effectiveness analysis.

Introduction

Preterm infants have immature development of various organs and low immunity, and are the key care group in the Neonatal Intensive Care Unit (NICU). The traditional unaccompanied care is dominated by medical staff. Although it ensures medical safety, it ignores the value of family participation, which easily leads to insufficient care ability of parents and poor rehabilitation compliance of children after discharge, affecting the long - term growth and development

outcomes [1].

Previous clinical studies have confirmed that the care model combining unaccompanied basic care with phased family participation can shorten the hospital stay of preterm infants, reduce the incidence of complications, improve the quality of care, and improve the long - term growth and development outcomes of children [2]. Under the background of limited medical resources and the deepening of DRG medical insurance payment reform, the promotion of new care models needs to take into account clinical effectiveness and medical economy.

At present, domestic and foreign studies on family - involved care for preterm infants mostly focus on the verification of clinical effects, and relevant health economic studies are relatively lacking. Moreover, they are mostly limited to the comparison of short - term costs during hospitalization, and lack a systematic cost - effectiveness evaluation with the long - term growth and development outcomes of children as indicators [3]. Based on this, relying on the data of randomized controlled trials, this study conducts an economic evaluation from the perspective of the medical and health system to clarify the cost - effectiveness of this combined care model, and provide empirical reference for clinical nursing decision - making, refined hospital management and optimization of medical insurance policies.

Materials and Methods

Research Design and Subjects

This study is a health economic evaluation supporting a randomized controlled trial. It has been approved by the hospital's medical ethics committee, and all guardians of children have given informed consent. Clinical trial registration number: ChiCTR2400084895.

Inclusion criteria: Preterm infants with a gestational age of 28 - 34 weeks, birth weight ≤ 2,500 g, stable vital signs, and high parental cooperation; Exclusion criteria: Preterm infants with congenital malformations, genetic metabolic diseases, critical conditions that cannot complete the intervention, and those lost to follow - up.

A total of 120 subjects were included and divided into an observation group and a control group with 60 cases each by random number table method. There was no statistical difference in baseline data such as gender, gestational age, and birth weight between the two groups ($P > 0.05$), and the grouping was balanced and comparable.

Nursing Intervention Measures Observation Group

The "unaccompanied basic care + phased family participation" combined model was adopted, and it was implemented in three stages according to the recovery of the child's condition:

Acute phase: Before the condition is stable (1 - 2 weeks), unaccompanied management is implemented, and parents visit via video for 15 minutes every day;

Stable phase: Before the child's weight reaches 1,800 g, parents participate in basic care for 30 minutes to 2 hours every day after training, and carry out kangaroo mother care [4];

Recovery phase: From the time when the child's weight is ≥ 1,800 g to discharge, parents lead the daily care work, and medical staff provide full supervision and training throughout the process to strengthen practical training of care skills [5].

Control Group: The traditional simple unaccompanied care was adopted. Medical staff were responsible for care throughout the process. Parents only visited for 15 minutes every day and did not participate in any nursing operations; Before discharge, medical staff gave routine oral care knowledge guidance without systematic practical training.

Cost Calculation: Direct medical costs during hospitalization were calculated from the perspective of the medical and health system. The costs were calculated according to the hospital's charging standards from 2021 to 2024. The study's hospitalization cycle was less than 3 months, so no cost discounting was done.

The cost composition included: drug costs, consumable costs, bed costs, nursing costs, and examination costs. The observation group additionally calculated the apportioned cost of parental care training.

Effect Indicators: Main effect indicator: Growth and development compliance rate at 3 years old (evaluated by the Denver II scale, with height and weight as the criteria for compliance determination); Secondary effect indicators: length of hospital stay, incidence of in - hospital complications, readmission rate 6 months after discharge, success rate of breastfeeding, and parental care ability score.

Health Economic Evaluation MethodsCost - effectiveness ratio (CER): CER = per capita total cost / effect rate, the lower the ratio, the better the economy;Incremental cost - effectiveness ratio (ICER): ICER = (cost of observation group - cost of control group) / (effect of observation group - effect of control group), a negative value means lower cost and better effect;Sensitivity analysis: Single - factor fluctuation analysis of ± 20% of core parameters was selected to verify the robustness of the results.

Statistical Processing SPSS 22.0 statistical software was used for data analysis. Measurement data were expressed as ($\bar{x} \pm s$) and tested by t - test, and count data were expressed as [n (%)] and tested by χ^2 test. $P < 0.05$ was considered statistically significant.

Results

Comparison of Costs During Hospitalization Between the Two Groups

The per capita total hospitalization cost and various sub - costs of the observation group were significantly lower than those of the control group. Although a small amount of train-

ing cost was incurred, the overall total cost was still lower, and the length of hospital stay was significantly shortened, with statistically significant differences (P < 0.001). See Table 1 for details.

Cost Item	Observation Group (n = 60)	Control Group (n = 60)	t Value	P Value
Drug cost	12,560 ± 2,130	15,870 ± 2,560	7.654	<0.001
Consumable cost	8,240 ± 1,560	10,120 ± 1,890	5.978	<0.001
Bed cost	6,550 ± 1,230	8,030 ± 1,360	6.401	<0.001
Nursing cost	9,180 ± 1,420	10,560 ± 1,580	5.134	<0.001
Examination cost	4,820 ± 890	5,700 ± 1,020	5.067	<0.001
Training cost	1,000 ± 120	0	-	-
Total	42,350 ± 5,620	51,280 ± 6,450	8.142	<0.001

Table 1 Comparison of Per Capita Costs During Hospitalization Between the Two Groups of Children (Yuan, $\bar{x} \pm s$)

Comparison of Effect Indicators Between the Two Groups: All effect indicators of the observation group were better than those of the control group. The growth and development compliance rate at 3 years old, the success rate of breastfeeding, and the parental care ability score were higher, while the incidence of complications and readmission rate were lower, with statistically significant differences (P < 0.05). See Table 2 for details.

Indicator	Observation Group (n = 60)	Control Group (n = 60)	Statistical Quantity	P Value
Growth and development compliance rate at 3 years old [n (%)]	55 (91.6)	44 (73.3)	$\chi^2 = 7.023$	0.008
Length of hospital stay (d, $\bar{x} \pm s$)	29.8 ± 5.6	36.5 ± 6.2	t = 6.324	<0.001
Total incidence of complications [n (%)]	7 (11.6)	17 (28.3)	$\chi^2 = 5.487$	0.019
Success rate of breastfeeding [n (%)]	49 (82.0)	34 (56.7)	$\chi^2 = 8.352$	0.004
Parental care ability score (score, $\bar{x} \pm s$)	85.6 ± 6.3	62.3 ± 7.5	t = 17.261	<0.001

Table 2 Comparison of Effect Indicators Between the Two Groups of Children

Cost - Effectiveness Analysis

Taking the growth and development compliance rate at 3 years old as the main indicator, the cost - effectiveness results are as follows:CER of the observation group = 42,350 yuan / 91.6% = 46,235 yuan per compliant caseCER of the control group = 51,280 yuan / 73.3% = 69,960 yuan per compliant caseEach compliant case in the observation group can save 23,725 yuan in cost, and the incremental cost - effectiveness ratio is negative, which is an absolute dominant scheme with cost saving and effect improvement.

Sensitivity Analysis

Single - factor fluctuation analysis of ± 20% was carried out on the core parameters. The results showed that the CER of the observation group was always lower than that of the control group, and the ICER was continuously negative. Even in extremely unfavorable scenarios, the economy of the observation group was still better than that of the control group, and the research results were robust and reliable.

Discussion

Cost - Saving Mechanism of the Combined Care Model

This study shows that the combined model can reduce the total hospitalization cost by 17.4%, with a per capita cost saving of 8,930 yuan. The core reason is the effective shortening of the length of hospital stay. Phased family participation can accelerate the recovery of children's conditions and reduce complications, indirectly reducing multiple costs such as drugs, consumables, and beds. A small amount of training investment is far lower than the amount of hospital cost savings, and finally the total cost is reduced [6].

Dual Advantages of Cost and Effect of the Combined Care Model

This model breaks through the industry dilemma of "increas-

ing effect and increasing cost" and achieves dual optimization of clinical and economic aspects. On the one hand, it makes up for the humanistic shortcomings of traditional care through family participation and improves the long - term growth and development quality of children; on the other hand, it realizes the controllability of medical costs by shortening hospitalization and reducing the risk of readmission, and optimizes the allocation of nursing manpower at the same time, improving the utilization rate of medical resources [7].

Clinical and Policy Guidance Significance

Under the background of DRG/DIP medical insurance payment reform, this model can help hospitals shorten the average length of stay, improve bed turnover rate, and effectively control the average cost per hospitalization, which is in line with the needs of refined hospital operation and medical insurance cost control; at the same time, it can optimize the nursing workflow, reduce the burden of basic care for nursing staff, take into account medical safety and family humanistic care, and improve the quality of nursing services. It is suggested that medical insurance departments include family - based care - related services in the payment scope, reasonably optimize the pricing of nursing services, and promote the comprehensive popularization of this model in grassroots NICUs [8].

Research Limitations

This study has certain limitations: first, it is a single - center and small - sample study, and the cost data is affected by the regional medical charging standards, so the extrapolation of the results is limited; second, only the direct medical costs of the medical and health system are calculated, and social indirect costs such as parents' lost wages and transportation costs are not included; third, the follow - up period is only up to 3 years old, and the long - term neurodevelopment and health costs need to be further tracked; in the future, multi - center and large - sample studies need to be carried out, the follow - up period should be extended, the economic evaluation methods should be improved, and the research conclusions should be further verified [9 - 10].

Conclusion

The unaccompanied combined family - based care model for preterm infants can significantly improve the growth and development compliance rate of preterm infants at 3 years old, shorten the length of hospital stay, and reduce direct medical costs. It has significant cost - effectiveness advantages and is a clinically feasible and economically efficient care plan. This model meets the needs of medical resource optimization and medical insurance cost control, and is worthy of clinical promotion and application in NICUs of hospitals at all levels.

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