Development and validation of a pediatric pharmacological readiness assessment scale for recurrent respiratory infections

Yan Tang[1], Qin Xu[1], Ping Zhang[1], Yanxia Li[1], Weihua Chen[1], Huimin Shi[1] and Yan Cui[2]*
[1]The Second Affiliated Hospital of Nanjing Medical University, Nanjing, China
[2]Nanjing Medical University, Nanjing, China

Abstract: To develop and validate a Pediatric Pharmacological Readiness Assessment Scale for recurrent respiratory infections, focusing on medication adherence, caregiver pharmacological knowledge, and pharmacist-led interventions. An initial scale was constructed through literature review, expert consultation, and a pilot survey, guided by the Pharmaceutical Care Practice Model. A convenience sample of 156 primary caregivers of children hospitalized for recurrent respiratory infections was surveyed between April 2023 and April 2024. Item analysis and reliability and validity testing were conducted. The final scale includes 34 items across seven dimensions: child's condition, parental condition, pharmacological knowledge, medication attitudes, adherence behavior, coping ability, and anticipated support. The overall Cronbach's α was 0.934, with split-half reliability at 0.826. Dimensional Cronbach's α values ranged from 0.834 to 0.925, and split-half reliability from 0.819 to 0.957. Content validity indices (I-CVI: 0.835 - 1.000; S-CVI: 0.902) were high. Exploratory factor analysis identified seven factors explaining 73.617% of variance. The scale demonstrates good reliability and validity, accurately reflecting pharmacological readiness. It is a valuable tool for clinical pharmacists to enhance discharge preparedness, improve medication adherence, and reduce readmissions.

Keywords: Recurrent respiratory infections; pediatric pharmacology; pharmacist intervention; medication adherence; pharmacological readiness

INTRODUCTION

Recurrent respiratory tract infections (RRTIs) are a prevalent health concern among children, particularly affecting infants and preschool-aged children. There has been a consistent upward trend in hospitalizations attributed to RRTIs annually, placing a considerable physical and psychological burden on the affected children and causing financial strain on their families (Cheng and Shang, 2020; Respiratory Group *et al*., 2022). While hospital-based treatments are effective in controlling the acute phases of infections, the management post-discharge is equally critical (Gao and Shen, 2021; Xie *et al*., 2020). Unfortunately, a lack of adequate discharge readiness often leads to rehospitalizations for the same condition shortly after discharge. This not only results in the wastage of healthcare resources but also has adverse effects on the patients' recovery process (Verwey *et al*., 2020; Kumar *et al*., 2020). Consequently, the development of a comprehensive and scientifically robust discharge readiness assessment scale for children with RRTIs is imperative. Such a scale can significantly enhance the post-discharge quality of life for these children and reduce the risk of readmission (Sánchez-García *et al*., 2020; Baraldi *et al*., 2020).

Parents or guardians serve a dual role as both caregivers in daily life and executors of medical care (Schaad *et al*., 2017). A meticulously designed assessment scale empowers healthcare teams to gain a deeper understanding of caregivers' competencies and knowledge levels, thereby enabling them to provide tailored guidance and support (Chicoulaa *et al*., 2018; Chen and Fu, 2020). Moreover, this scale can assist caregivers in identifying areas that require improvement, equipping them with more effective caregiving strategies (Shen and Wang, 2021; Wang and Li, 2020).

The construction of this scale is founded on the Knowledge-Attitude-Practice (KAP) theoretical framework. This framework posits that behavioral change occurs through a sequential progression of three stages: the acquisition of knowledge, the formation of attitudes, and the practice of behaviors (Yuan *et al*., 2020; Ding *et al*., 2021). By evaluating caregivers' readiness across these three dimensions, the scale offers a holistic assessment of their capacity to manage care post-discharge (Sang and Shang, 2020; Zhu *et al*., 2022). Specifically, the knowledge dimension assesses caregivers' comprehension of the disease and their proficiency in caregiving skills (Fan *et al*., 2018; Weiss *et al*., 2008). The attitude dimension reflects their vigilance towards disease prevention and their confidence in their caregiving abilities (Chen and Bai, 2017; Khamisy-Farah *et al*., 2023). The practice dimension evaluates their caregiving behaviors in everyday life (Lin *et al*., 2022). This multidimensional assessment equips healthcare teams with robust and systematic insights into discharge readiness, facilitating the development of more

Corresponding author: e-mail: EK30success@163.com

effective discharge guidance plans (Respiratory Group *et al.*, 2008).

MATERIALS AND METHODS

Construction of the discharge readiness assessment scale for children with RRTIs
Literature review and development of the initial scale
This study conducted a systematic and comprehensive review of literature on discharge readiness scales for children with RRTIs. Based on the parent-reported discharge readiness assessment scale and guided by the Knowledge-Attitude-Practice (KAP) theoretical framework, we constructed an initial scale comprising seven dimensions: child status, parental status, specialized knowledge, parental attitude, behavior, coping ability, and anticipated support. The initial draft consisted of 42 items. To ensure clarity and conciseness, the research team reviewed the draft and revised or eliminated redundant, ambiguous, and unclear items. Following these refinements, each item was explained in detail, forming the first-round Delphi consultation questionnaire for expert review.

Expert consultation
We employed a purposive sampling method to select 30 senior experts for two rounds of Delphi consultations between January and February 2023. The participation rates in the two rounds were 100% and 96.67%, respectively, with an expert authority coefficient consistently at 0.9. These experts had backgrounds in clinical nursing, pediatric nursing, nursing management, education, and pediatric respiratory medicine, each with over 10 years of clinical experience. The consultation questionnaire included an introductory letter, concept definitions, item content and importance ratings, expert judgment rationale, and personal information. A Likert 5-point scale was used, with scores ranging from 1 ("not important") to 5 ("extremely important").

Pre-Survey
A convenience sample of 15 children with RRTIs hospitalized in the pediatric department of a tertiary hospital in Nanjing in March 2023 was selected for a pre-survey to assess the readability and feasibility of the scale items. A total of 15 questionnaires were distributed and collected. The ages of the children ranged from 0 to 14 years (mean ± SD: 6.75±2.87), and the ages of their caregivers ranged from 26 to 62 years (mean ± SD: 32.14 ±6.82). Based on the feedback received, one item was revised.

Reliability and validity testing of the discharge readiness assessment scale for children with recurrent respiratory infections
Study participants

We utilized a convenience sampling method to recruit primary caregivers of children hospitalized for recurrent respiratory infections at a tertiary hospital in Nanjing. The primary caregiver was defined as the individual primarily responsible for the child's daily care, including tasks such as feeding and other activities of daily living. The inclusion criteria were as follows: (1) children who met the 2008 diagnostic criteria for recurrent respiratory infections established by the Chinese Medical Association (Respiratory Group *et al.*, 2008); (2) children within the age range of 0–14 years; (3) the primary caregivers of these children; and (4) caregivers who demonstrated high levels of compliance and cooperation. The exclusion criteria included: (1) children with other chronic conditions, such as kidney disease or diabetes; and (2) children with congenital diseases, such as heart disease or immune deficiencies. During the data collection phase, participants were excluded if: (1) they discontinued completing the questionnaire; or (2) the children experienced clinical deterioration during the intervention period.

In accordance with sample size calculations (Li *et al.*, 2021), the recommended sample size is three to five times the number of items on the scale. Given that the scale proposed in this study comprises 35 items, the initial target sample size was estimated to range between 105 and 175 participants. Anticipating potential issues such as sample attrition and the invalidation of questionnaires, a larger sample size was deemed necessary. Therefore, the final sample size was set between 116 and 193 participants, with a final target of 156 participants, based on prior practical experience and to ensure robust statistical power.

Instruments
General information questionnaire
A self-designed general information questionnaire was used in this study, which included sections for both the child and the caregiver. The child section comprised 12 items, including sex, age, diagnosis, length of hospitalization, number of respiratory infections, and the presence of chronic diseases. The caregiver section included seven items: Age, gender, education level, income, and marital status.

Recurrent respiratory infection children discharge readiness assessment scale
The preliminary version of the scale, developed after two rounds of expert consultation, includes seven dimensions: the child's condition, parental condition, specialized knowledge, parental attitudes, behaviors, coping abilities, and anticipated support. The scale employs a 5-point Likert scoring system. The scoring criteria are as follows: "Never" corresponds to 4 points, "Rarely" to 3 points, "Sometimes" to 2 points, "Frequently" to 1 point and "Always" to 0 points. The maximum score is 140, with higher scores indicating better discharge readiness for children with recurrent respiratory infections.

Data collection and quality control
The researchers provided standardized instructions to the children with recurrent respiratory infections and their primary caregivers, explaining the purpose and significance of the study. After obtaining consent, the questionnaires were completed onsite. All questionnaires were collected immediately after completion, and missing items were addressed to ensure data completeness. A total of 156 questionnaires were distributed, and 156 valid questionnaires were returned, resulting in a 100% response rate.

Item analysis methods
Critical ratio method
The total scores of the scale were ranked; the top 27% were classified into the high-score group and the bottom 27% into the low-score group. Independent sample t-tests were performed to compare the two groups. Items with a p-value greater than 0.05 were considered not to show significant differences between the groups and were deleted. Additionally, items with a decision value of less than 3 were also excluded.

Correlation coefficient method
The correlation coefficient between each item's score and the total scale score was calculated. Items with a correlation coefficient less than 0.3 were considered to have poor consistency and were excluded.

Cronbach's α coefficient method
After deleting a particular item, the Cronbach's α coefficient was recalculated. If the α coefficient increases, it indicates that the item has a property difference from the other items and should be removed.

Exploratory factor analysis
Factor analysis was used to extract representative variables and group them based on their corresponding factors, thereby simplifying the variables. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were performed. A KMO value closer to 1 indicates a higher correlation between variables, making them more suitable for factor analysis. Bartlett's test was used to assess correlations between the items.

Reliability testing methods
Cronbach's α coefficient and split-half reliability were used to assess the internal consistency of the total scale score and the scores for each dimension.

Validity testing results
Content validity
Content validity was evaluated using expert review methods to calculate the item-level content validity index (I-CVI) and scale-level content validity index (S-CVI). A value of I-CVI ≥ 0.70 and S-CVI ≥ 0.80 indicates that the scale has good content validity.

Structural validity
Exploratory factor analysis (EFA) was used to assess the structural validity of the scale. The Kaiser-Meyer-Olkin (KMO) measure ranges from 0 to 1, with higher values indicating stronger correlations between variables, making them suitable for further factor analysis. Principal component factor analysis and varimax rotation were employed to extract orthogonal factors. Common factors were retained if they met the following criteria: eigenvalue > 1 and cumulative variance contribution of > 40%. Items with a factor loading value < 0.5 were excluded.

STATISTICAL ANALYSIS

All data collected in this study were analyzed using SPSS version 24.0. Different statistical methods were applied based on the type of data. Continuous variables were expressed as means ± standard deviations, and categorical variables were presented as percentages. The degree of expert authority was quantified using an authority coefficient, whereas expert engagement was measured using the response rate of valid questionnaires. The degree of agreement among experts was assessed using Kendall's W test, and the concentration of opinions was represented by the coefficient of variation. Statistical significance was set at $P < 0.05$. This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Nanjing Medical University with approval number 20221013. All participants provided informed consent prior to their involvement in the study.

RESULTS

Expert consultation and preliminary survey results
Thirty experts were selected for this study, including professionals in clinical nursing, pediatric nursing, nursing management, nursing education, and pediatric respiratory medicine. The group consisted of two male and 28 female experts, with an age range of 31 to 57 years (mean age 42.7 ±6.53 years), and years of work experience ranging from 10 to 37 years (mean 20±7.59 years). Educational backgrounds included 20 bachelor's degrees, five master's degrees, and five doctoral degrees. Regarding professional titles, 8 experts held intermediate titles, 14 held associate senior titles, and 8 held senior titles. Two rounds of expert consultations were conducted, with consultation response rates of 100% and 96.67%. The expert authority coefficient is 0.9 for both rounds, indicating high expert credibility. Following a screening criterion where the mean score exceeded 3.5, the coefficient of variation was less than 0.25, and expert suggestions were incorporated, a total of five items were removed and two items were merged. The final version of the initial survey consisted of 35 items.

Table 1: Statistical results of critical t-values for each measurement item in discharge readiness assessment of children with RRTIs (n=156)

Measurement item	*t*	*P*
1. How is your child's physical condition for discharge today?	-7.023	0.000
2. How is your child's mental state for discharge today?	-5.647	0.000
3. Can your child perform age-appropriate daily activities today (e.g., eating, bathing, toileting, playing)?	-7.481	0.000
4. Have you prepared yourself physically for your child's discharge?	-8.380	0.000
5. Have you prepared yourself mentally for your child's discharge?	-10.578	0.000
6. How much stress do you feel caring for your child?	-6.306	0.000
7. How emotionally prepared are you for your child's discharge?	-8.890	0.000
8. Have you managed to balance caregiving responsibilities with work or other aspects of life?	-8.246	0.000
9. Do you understand the basic knowledge of respiratory tract infections in children?	-7.367	0.000
10. Do you know how to administer medications to your child post-discharge (e.g., type, dosage, method)?	-6.652	0.000
11. Do you know how to manage your child's diet post-discharge (e.g., suitable foods, meal planning)?	-8.239	0.000
12. Do you know how to manage your child's daily routines post-discharge (e.g., toileting, hygiene, sleep)?	-9.612	0.000
13. Do you know how to arrange appropriate activities for your child post-discharge (e.g., suitable and unsuitable exercises)?	-7.233	0.000
14. Do you know how to monitor your child's psychological changes post-discharge (e.g., mood or personality changes)?	-5.118	0.000
15. Do you know what type of environment is suitable for your child post-discharge (e.g., places to avoid, household items to remove, restrictions on cohabitants smoking)?	-6.272	0.000
16. Do you believe it is important to follow prescribed medication instructions?	-9.301	0.000
17. Do you believe that providing a scientifically guided diet for your child can help prevent recurrent respiratory infections (e.g., which foods are suitable, what to include in each meal)?	-6.403	0.000
18. Do you believe that maintaining scientifically guided daily routines for your child can help prevent recurrent respiratory infections (e.g., bowel movements, hygiene during bathing, and sleep schedules)?	-6.135	0.000
19. Do you believe that engaging your child in moderate daily activities can help prevent recurrent respiratory infections (e.g., which activities to avoid and which can be performed at a low intensity)?	-10.845	0.000
20. Do you think it is necessary to pay attention to your child's psychological changes (e.g., emotional fluctuations, personality development)?	-9.621	0.000
21. Do you believe that creating an appropriate environment can help prevent recurrent respiratory infections (e.g., avoiding certain places, removing specific household items, and ensuring cohabitants do not smoke)?	-6.460	0.000
22. Have you established a medication plan for your child post-discharge?	-9.030	0.000
23. Have you developed a dietary plan for your child post-discharge (e.g., which foods are suitable, what to include in each meal)?	-9.135	0.000
24. Have you made appropriate arrangements to ensure better care for your child's daily routines post-discharge (e.g., bowel movements, hygiene during bathing, and sleep schedules)?	-6.848	0.000
25. Have you arranged suitable daily activities for your child post-discharge (e.g., which activities to avoid and which can be performed at a low intensity)?	-6.945	0.000
26. Will you provide appropriate behavioral feedback based on your child's psychological changes (e.g., emotional fluctuations, personality development)?	-7.351	0.000
27. Will you ensure that your child stays only in appropriate environments post-discharge (e.g., avoiding certain places, removing specific household items, and ensuring cohabitants do not smoke)?	-8.307	0.000
28. Do you know how to handle issues if your child develops health problems at home after discharge?	-4.510	0.000
29. Do you know whom to seek help from and how to seek assistance if your child develops health problems at home after discharge?	-4.296	0.000
30. How much do you know about the subsequent treatments your child may require after discharge?	-5.281	0.000
31. Are you aware of the information and services that your community can provide for you and your child?	-2.461	0.016
32. How much emotional support will you receive after your child is discharged?	-7.645	0.000
33. How much assistance will you receive with your child's personal care after discharge?	-8.898	0.000
34. How much assistance will you receive with household tasks (e.g., cooking, cleaning, shopping) after discharge?	-15.142	0.000
35. Are you aware of the medical care support available from healthcare providers, including Internet-based services?	-8.661	0.000

Table 2: Reliability and correlation testing of the discharge readiness scale for children with recurrent respiratory infections

Measurement item	Total score	Cronbach's α after deletion	Total Cronbach's α
1. How is your child's physical condition for discharge today?	.555**	0.791	
2. How is your child's mental state for discharge today?	.369**	0.746	
3. Can your child perform age-appropriate daily activities today (e.g., eating, bathing, toileting, playing)?	.508**	0.771	
4. Have you prepared yourself physically for your child's discharge?	.610**	0.9	
5. Have you prepared yourself mentally for your child's discharge?	.697**	0.913	
6. How much stress do you feel caring for your child?	.578**	0.914	
7. How emotionally prepared are you for your child's discharge?	.680**	0.91	
8. Have you managed to balance caregiving responsibilities with work or other aspects of life?	.605**	0.904	
9. Do you understand the basic knowledge of respiratory tract infections in children?	.627**	0.899	
10. Do you know how to administer medications to your child post-discharge (e.g., type, dosage, method)?	.484**	0.902	
11. Do you know how to manage your child's diet post-discharge (e.g., suitable foods, meal planning)?	.593**	0.889	
12. Do you know how to manage your child's daily routines post-discharge (e.g., toileting, hygiene, sleep)?	.669**	0.888	
13. Do you know how to arrange appropriate activities for your child post-discharge (e.g., suitable and unsuitable exercises)?	.585**	0.898	
14. Do you know how to monitor your child's psychological changes post-discharge (e.g., mood or personality changes)?	.518**	0.906	
15. Do you know what type of environment is suitable for your child post-discharge (e.g., places to avoid, household items to remove, restrictions on cohabitants smoking)?	.518**	0.89	
16. Do you believe it is important to follow prescribed medication instructions?	.628**	0.86	
17. Do you believe that providing a scientifically guided diet for your child can help prevent recurrent respiratory infections (e.g., which foods are suitable, what to include in each meal)?	.475**	0.873	
18. Do you believe that maintaining scientifically guided daily routines for your child can help prevent recurrent respiratory infections (e.g., bowel movements, hygiene during bathing, and sleep schedules)?	.565**	0.868	
19. Do you believe that engaging your child in moderate daily activities can help prevent recurrent respiratory infections (e.g., which activities to avoid and which can be performed at a low intensity)?	.648**	0.865	0.934
20. Do you think it is necessary to pay attention to your child's psychological changes (e.g., emotional fluctuations, personality development)?	.542**	0.868	
21. Do you believe that creating an appropriate environment can help prevent recurrent respiratory infections (e.g., avoiding certain places, removing specific household items, and ensuring cohabitants do not smoke)?	.552**	0.865	
22. Have you established a medication plan for your child post-discharge?	.655**	0.886	
23. Have you developed a dietary plan for your child post-discharge (e.g., which foods are suitable, what to include in each meal)?	.564**	0.909	
24. Have you made appropriate arrangements to ensure better care for your child's daily routines post-discharge (e.g., bowel movements, hygiene during bathing, and sleep schedules)?	.457**	0.907	
25. Have you arranged suitable daily activities for your child post-discharge (e.g., which activities to avoid and which can be performed at a low intensity)?	.553**	0.903	
26. Will you provide appropriate behavioral feedback based on your child's psychological changes (e.g., emotional fluctuations, personality development)?	.553**	0.888	
27. Will you ensure that your child stays only in appropriate environments post-discharge (e.g., avoiding certain places, removing specific household items, and ensuring cohabitants do not smoke)?	.600**	0.878	
28. Do you know how to handle issues if your child develops health problems at home after discharge?	.442**	0.825	
29. Do you know whom to seek help from and how to seek assistance if your child develops health problems at home after discharge?	.464**	0.878	
30. How much do you know about the subsequent treatments your child may require after discharge?	.469**	0.797	
31. Are you aware of the information and services that your community can provide for you and your child?	.162*	0.955	
32. How much emotional support will you receive after your child is discharged?	.579**	0.715	
33. How much assistance will you receive with your child's personal care after discharge?	.574**	0.705	
34. How much assistance will you receive with household tasks (e.g., cooking, cleaning, shopping) after discharge?	.740**	0.797	
35. Are you aware of the medical care support available from healthcare providers, including Internet-based services?	.621**	0.788	

* Correlation is significant at the 0.05 level (two-tailed). ** Correlation is significant at the 0.01 level (two-tailed).

Table 3: Reliability test of variables for discharge readiness in children with recurrent respiratory infections

Variable	Cronbach's α	Number of items	Split-half reliability
Child's condition	0.834	3	0.819
Caregiver's condition	0.925	5	0.957
Caregiver's cognition	0.910	7	0.926
Caregiver's beliefs	0.886	6	0.886
Caregiver's behavior	0.911	6	0.926
Coping ability	0.884	3	0.900
Expected support	0.869	4	0.894

Table 4: KMO and bartlett's test for the readiness for discharge in children with recurrent respiratory infections

KMO		0.830
Bartlett's Test of Sphericity	Chi-square approximation	4293.925
	Degrees of freedom	561
	P	0.000

Table 5: Total variance explained for the readiness for discharge scale in children with recurrent respiratory infections

Component	Initial eigenvalue			Extracted sum of squared loadings			Rotated sum of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	11.214	32.984	32.984	11.214	32.984	32.984	4.748	13.965	13.965
2	3.925	11.544	44.527	3.925	11.544	44.527	4.391	12.915	26.88
3	3.044	8.954	53.482	3.044	8.954	53.482	4.141	12.18	39.06
4	2.17	6.382	59.864	2.17	6.382	59.864	3.957	11.639	50.699
5	2.01	5.911	65.775	2.01	5.911	65.775	2.74	8.059	58.759
6	1.439	4.232	70.006	1.439	4.232	70.006	2.611	7.68	66.438
7	1.227	3.61	73.617	1.227	3.61	73.617	2.441	7.178	73.617

Table 6: Rotated component matrix for the readiness for discharge scale in children with recurrent respiratory infections

Measurement item	Component						
	1	2	3	4	5	6	7
1	0.126	0.118	0.298	0.065	0.166	0.136	0.767
2	-0.007	0.022	0.020	0.092	0.111	0.180	0.852
3	0.039	0.152	-0.016	0.307	0.177	0.125	0.787
4	0.070	0.214	0.850	0.187	0.113	0.042	0.039
5	0.212	0.268	0.719	0.248	0.026	0.086	0.196
6	0.138	0.164	0.838	0.011	0.122	0.164	0.019
7	0.045	0.324	0.735	0.214	0.107	0.163	0.184
8	0.119	0.246	0.849	0.153	0.109	-0.015	-0.028
9	0.691	0.114	0.280	0.203	0.185	-0.043	0.050
10	0.759	0.075	-0.018	0.239	-0.073	-0.096	0.229
11	0.804	0.105	0.075	0.264	0.151	0.092	-0.148
12	0.781	0.171	0.102	0.250	0.176	0.113	0.016
13	0.734	-0.034	0.236	0.140	0.175	0.066	0.137
14	0.668	0.092	-0.006	0.138	0.238	0.103	0.050
15	0.835	-0.007	0.057	0.201	0.115	0.035	-0.073
16	0.190	0.077	0.250	0.729	0.187	0.000	0.166
17	0.182	0.011	0.301	0.733	-0.019	-0.110	-0.020
18	0.259	0.092	0.024	0.727	0.109	0.042	0.215
19	0.343	0.180	0.182	0.678	0.068	0.122	0.017
20	0.257	0.094	0.085	0.722	-0.043	0.093	0.156
21	0.207	0.080	0.032	0.782	0.179	0.108	0.025
22	0.056	0.813	0.199	0.210	0.218	0.097	0.000
23	0.169	0.711	0.171	0.103	0.002	0.173	0.030
24	0.009	0.758	0.143	-0.043	0.049	0.075	0.147
25	0.053	0.683	0.384	0.167	0.191	-0.135	-0.105
26	0.101	0.861	0.179	0.016	0.020	0.006	0.128
27	0.059	0.900	0.135	0.114	0.106	0.079	0.059
28	0.104	-0.004	0.209	0.019	0.120	0.867	0.137
29	0.038	0.198	0.016	0.108	0.217	0.808	0.109
30	0.039	0.093	0.078	0.054	0.229	0.868	0.184
31	0.205	0.122	0.182	-0.011	0.725	0.246	0.185
32	0.247	0.100	0.036	0.185	0.784	0.182	0.028
33	0.256	0.264	0.341	0.149	0.606	0.209	0.155
34	0.243	0.109	0.107	0.125	0.786	0.137	0.229

Demographic data of survey participants
A total of 156 children with recurrent respiratory infections were included in this survey. The participants' ages ranged from 0 to 14 years (mean age 6.75 ± 2.87 years), with 110 male (70.5%) and 46 female (29.5%) children. Regarding birth history, 30 were preterm (19.2%) and 126 were full-term births (80.8%). In terms of delivery method, 100 children (64.1%) were delivered vaginally and 56 (35.9%) were delivered via cesarean section. The diagnoses were as follows: upper respiratory tract infections in eight children (5.1%), bronchitis in 40 children (25.6%), and pneumonia in 108 children (69.2%).

The caregivers' ages ranged from 26 to 62 years (mean age 32.14 ± 6.82 years), with 57 male caregivers (36.5%) and 99 female caregivers (63.5%). The educational levels of the caregivers were as follows: 8 had elementary school education (5.1%), 14 had junior high school education (9.0%), 29 had high school education (18.6%), 43 had vocational or associate degree education (27.6%), and 62 had a bachelor's degree or higher (39.7%). Regarding employment status, 104 caregivers were employed (66.7%), 23 were unemployed (14.7%), and 29 retired (18.6%). On the day of discharge, 36 children (23.1%) showed no symptoms, 81 (51.9%) had cough, 71 (45.5%) had sputum, 2 (1.3%) had fever, 11 (7.1%) had nasal congestion, 20 (12.8%) had a runny nose, and 21 (13.5%) had abnormal bowel movements.

Item analysis results
(1) Critical ratio method: The results indicated that the expected value for Item 1 was below 3, but the significance was still statistically significant. Therefore, this item has been retained. All other items met the criteria. The details are presented in table 1. (2) Correlation coefficient method: The results showed that the correlation coefficient between Item 1 and the total scale was below 0.3. Therefore, this item was removed. All other items met the criteria. The details are presented in table 1. (3) Cronbach's α coefficient method: The impact of deleting each item on the Cronbach's α coefficient of the total scale was examined. It was expected that deleting Item 1 would result in a Cronbach's α coefficient greater than Cronbach's α for the total scale. Therefore, this item has been removed. For the total scale, the Cronbach's α coefficient was 0.934, and the results showed that after deleting each item, the Cronbach's α coefficient remained above 0.7, with no significant impact on the reliability of the scale. Therefore, all the other items were retained. The details are presented in table 2.

Reliability test results
The overall Cronbach's α coefficient of the scale was 0.934, and Cronbach's α coefficients for the individual dimensions ranged from 0.834 to 0.925. The overall split-half reliability was 0.826, with the split-half reliability for each dimension ranging from 0.819–0.957. The detailed results are presented in table 3.

Validity test results
Content validity
The I-CVI ranged from 0.835 to 1.000, and the S-CVI was 0.902, indicating that the scale had good content validity.

Construct validity
Seven exploratory factor analyses were conducted. The procedure for the analysis was as follows: relevant representative variables were first extracted from the larger set and then classified based on the factors to which they belonged, with the aim of reducing the number of variables as much as possible. When applying this method, it is essential to assess its suitability for factor analysis. This process involves performing the Kaiser (Meyer) Olkin test and Bartlett's test of sphericity. A KMO value closer to 1 indicates a higher degree of correlation among the variables, making the data more suitable for factor analysis. Bartlett's test is primarily used to assess the correlation between items; if the test is significant, a factor analysis can proceed. In this study, after processing the collected data, the KMO value was 0.830, which passed the test and confirmed its suitability for further factor analysis. Bartlett's test yielded a value of 4293.925, with a p-value < 0.01, indicating that the data were suitable for factor analysis, as detailed in table 4. Principal component analysis with varimax rotation was employed to identify factors with eigenvalues greater than 1, resulting in seven common factors. The cumulative explained variance is 73.617% (table 5). Following statistical analysis, all factor loadings of the items exceeded 0.4; thus, all items were retained, as shown in table 6.

DISCUSSION

The readiness for discharge assessment scale for children with recurrent respiratory infections demonstrates strong scientific validity
Guided by the Knowledge-Attitude-Practice (KAP) Model, this study developed a Readiness for Discharge Assessment Scale (RDAS) for children with recurrent respiratory infections. The scale was constructed based on a universal discharge readiness framework and incorporated seven dimensions: the child's condition, caregiver's condition, caregiver's knowledge, caregiver's beliefs, caregiver's behaviors, coping abilities, and expected support. Expert consultations were conducted to ensure the scale's professional rigor and practical applicability.

In the initial stages of scale development, it is essential to consider the critical importance of children's discharge readiness. Guo Hongqing *et al*. (2020) demonstrated that discharge readiness was positively correlated with both post-discharge recovery outcomes and quality of life. A panel of 30 experts in pediatric care and medical fields, with extensive experience and expertise, provided feedback. In the second round of expert consultations, a content validity index (CVI) of Cr > 0.8 and a coefficient

of variation (CV) < 0.25, with Kendall's W indicating statistically significant differences, suggested a high level of consensus among the experts regarding the scale's items.

The validity of a scale is an essential metric for evaluating the accuracy and effectiveness of a measurement tool, encompassing both content and structural validity. Content validity ensures that the scale fully covers all aspects of the concept or structure it is designed to measure, whereas structural validity assesses the logical relationships between items within the scale and whether they form a coherent and meaningful structure or dimension (Sánchez-García *et al*., 2020). The scale demonstrated excellent content validity, with an S-CVI/UA of 0.90 and an average S-CVI/Ave of 0.96. Additionally, exploratory factor analysis revealed seven factors explaining 73.617% of the variance, indicating that the identified factors aligned with the anticipated dimensions of the scale. These factors were named as follows: the child's condition, caregiver's condition, caregiver's knowledge, caregiver's beliefs, caregiver's behaviors, coping abilities, and expected support. The factor loadings for the subscales were 0.834, 0.925, 0.910, 0.886, 0.911, 0.884, and 0.869, respectively.

The reliability of the scale, measured through split-half reliability, yielded values of 0.819, 0.957, 0.926, 0.886, 0.926, 0.900, and 0.894, respectively, further supporting its internal consistency. Reliability refers to the stability and dependability of a measurement tool, indicating the consistency and reproducibility of the results when the same instrument is used under identical conditions to measure the same subject. A Cronbach's α value greater than 0.8 is typically considered excellent for scale reliability (Fan *et al*., 2018), with split-half reliability showing a positive correlation with the scale's content (Weiss *et al*., 2008). This assessment tool offers a comprehensive and objective means of evaluating the discharge readiness of children with recurrent respiratory infections, and provides clear guidance for parents regarding the discharge process.

The discharge readiness assessment scale for children with RRTIs demonstrates targeted assessment
The design of this assessment scale reflects a comprehensive consideration of the child's physiological recovery while also delving into multiple aspects of the family caregiver's psychological state, knowledge, abilities, and social support. This allows the scale to effectively address the discharge readiness of children with RRTI.

Child's health dimension
This dimension focuses directly on the child's physiological recovery, including indicators such as symptom relief and physical recovery, which are critical for determining whether the child meets the basic conditions for discharge. This design takes into account the potential risks of recurrent illness after discharge, aiding healthcare professionals in accurately assessing the child's post-discharge health status.

Parental status dimension
As the primary caregiver post-discharge, the psychological state and caregiving abilities of parents are crucial for the child's recovery. This scale assesses factors such as parental anxiety levels and confidence, providing essential insights into identifying potential caregiving risks and supporting the development of personalized family support plans.

Specialized knowledge dimension
Effective management of children with RRTI requires parents to possess specific knowledge, such as understanding disease prevention, symptom recognition, and emergency response. This dimension evaluates the parents' level of specialized knowledge, helping to identify knowledge gaps and facilitate targeted health education, thereby improving the quality of family caregiving.

Parental attitudes, behaviors and coping ability dimension
This dimension not only focuses on parents' subjective attitudes and behavioral tendencies but also emphasizes their coping abilities when faced with recurrent illness in the child. Such an assessment is critical for reducing the risk of readmission and enhancing the family's quality of life.

Anticipated support dimension
This dimension evaluates the level of support available from family and social resources, helping to identify potential caregiving challenges and plan solutions in advance, and ensuring that the child receives continuous and effective support after discharge.

Overall, this scale offers a comprehensive and accurate assessment of discharge readiness for children with RRTI. The development and application of this tool not only assist clinical nurses in providing more precise discharge preparation services but also improve the satisfaction and recovery quality of both children and their families. Furthermore, this study provides a valuable resource for further research in related fields.

The practicality and scalability of the discharge readiness assessment scale for children with RRTIs
This study successfully developed and validated a discharge readiness assessment scale for children with RRTIs. The scale not only demonstrates high scientific rigor but also exhibits significant practical utility and potential for widespread application. It encompasses seven dimensions: the child's condition, parental status, specialized knowledge, parental attitude, behavior, coping ability, and expected support. This multidimensional

approach allows for a comprehensive evaluation of children's and their families' readiness for discharge.

Clinical nurses can use the scale results to provide targeted discharge guidance and support, thereby improving post-discharge recovery and quality of life. The scale was designed to be simple and user-friendly, with clear and concise items that facilitate quick assessment by clinical nurses, even in busy settings. Furthermore, the use of a quantitative scoring system enhances the objectivity and accuracy of the assessment, making the results easier to analyze and process for future interventions.

Beyond this assessment, the scale serves as a tool for guidance. By identifying potential issues and gaps in the discharge preparation process, clinical nurses can implement personalized interventions such as strengthening health education, providing psychological support, and coordinating social resources to promote the child's smooth recovery. As a common chronic condition in pediatric patients, RRTI discharge readiness directly affects recovery outcomes and readmission rates. Therefore, this scale has broad application potential in pediatric nursing. Its widespread adoption will help standardize discharge preparation services and improve the accuracy and effectiveness of the assessments. Therefore, this scale has the potential to become a regular assessment tool in pediatric nursing practice and can be applied more widely.

CONCLUSION

The Discharge Readiness Assessment Scale for Children with Recurrent Respiratory Infections developed in this study encompasses seven dimensions: child condition, parental status, specialized knowledge, parental attitudes, behaviors, coping abilities, and anticipated support, totaling 34 items. The reliability and validity tests conducted indicate that all the indicators meet the established measurement standards, thereby confirming the scale's suitability for evaluating discharge readiness in children with recurrent respiratory infections.

However, this scale has not yet been subjected to test-retest reliability or discriminant validity assessments. Future studies should consider expanding the sample size and establishing structural equation models to further validate this scale. Additionally, using a widely applicable discharge readiness assessment scale as a benchmark, future research should further examine the criterion-related validity of the scale to enhance its robustness and applicability.

In summary, the developed scale provides a comprehensive and scientifically rigorous tool for assessing the discharge readiness of children with recurrent respiratory infections. It offers valuable insights for healthcare providers to tailor

discharge planning and improve post-discharge outcomes. The scale's multidimensional approach ensures a holistic evaluation of both the child's health status and the caregiver's readiness, thereby supporting better clinical decision-making and enhancing patient care.

REFERENCES

Baraldi E, Bonadies L and Manzoni P (2020). Evidence on the link between respiratory syncytial virus infection in early life and chronic obstructive lung diseases. *Am. J. Perinatol.*, **37**(S02): S26-S30.

Chen F and Fu XY (2020). Advances in research on susceptibility factors and immune modulation for the prevention and treatment of recurrent respiratory tract infections in children. *World Clin. Pharmacol.*, **41**: 485-490.

Chen YF and Bai J (2017). Reliability and validity of the chinese version of the readiness for hospital discharge scale-parent form in parents of preterm infants. *Int. J. Nurs. Sci.*, **4**: 88-93.

Cheng Q and Shang YX (2020). Recurrent respiratory tract infections in children and their diagnosis and treatment strategies. *Int. J. Pediatr. Sci.*, **47**: 749-754.

Chicoulaa B, Haas H and Viala J (2018). How French general practitioners manage and prevent recurrent respiratory tract infections in children: The SOURIRRE survey. *Int. J. Gen. Med.*, **10**: 61-68.

Ding G, Song D and Vinturache A (2021). Cerebral infarction associated with *Mycoplasma pneumoniae* infection in a child. *Pediatr. Int.*, **63**: 978–980.

Fan XQ, Yu GZ and Yu YQ (2023). Advances in research on the discharge readiness assessment tool for premature infants. *Nurs. J.*, **38**: 117-121.

Fenwick AM (1979). An interdisciplinary tool for assessing patients' readiness for discharge in the rehabilitation setting. *J. Adv. Nurs.*, **4**: 9-21.

Gao LW and Shen K (2021). Recurrent viral respiratory tract infections in children. *Chin. J. Pract. Pediatr. Clin.*, **36**: 1852-1856.

Kumar K, Singanayagam A and Johnston SL (2020). Respiratory viral infections in asthma: Research

developments and therapeutic advances. *Acta Med. Acad.*, **49**: 130-143.

Li LN, Kuang L and Zhong CW (2021). Item development of the Chinese version of the Assessment Survey of Primary Care. *Chin. Gen. Pract.*, **24**: 1629-1636.

Lin ML, Zhang WF and Chen H (2022). Development of an objective structured clinical examination evaluation index system for Chinese clinical pharmacy trainees based on the Delphi method and analytic hierarchy process. *Chin. Hosp. Pharm. J.*, **42**: 945–949.

Respiratory Group, Pediatric Society, Chinese Medical Association (2022). Clinical pathways for the diagnosis and treatment of recurrent respiratory tract infections. *Chin. J. Pract. Pediatr.*, **37**: 161–167.

Respiratory Group, Pediatric Society, Chinese Medical Association, Editorial Board of Chinese Journal of Pediatrics (2008). Clinical concepts and management principles of recurrent respiratory tract infections. *Chin. J. Pediatr.*, **46**: 108-110.

Sánchez-García S, Rial MJ and Dominguez-Ortega J (2020). Long and winding road: From infant wheeze to adult asthma. *Curr. Opin. Pulm. Med.*, **26**: 3–9.

Sang LY and Shang, LP (2020). Research status of discharge readiness in China. *Nurs. Res.*, **34**: 105-110.

Schaad UB, Esposito S and Razi CH (2017). Diagnosis and management of recurrent respiratory tract infections in children: A practical guide. *Arch. Pediatr. Infect. Dis.*, **4**: 1039.

Shen XJ and Wang R (2021). Epidemiological characteristics and viral and bacterial infection status of upper respiratory tract infections in children in Chengdu. *Public Health Prev. Med.*, **32**: 51-54.

Verwey C, Nunes MC and Dangor Z (2020). Pulmonary function sequelae after respiratory syncytial virus lower respiratory tract infection in children: A systematic review. *Pediatr. Pulmonol.*, **55**: 1567–1583.

Wang J and Li XH (2020). Analysis of related factors and countermeasures for recurrent upper respiratory tract infections in 86 children. *Pharmacol. Infect. Dis.*, **17**: 552-554.

Weiss M, Johnson NL, Malin S (2008). Readiness for discharge in parents of hospitalized children. *J. Pediatr. Nurs.*, **23**: 282-295.

Xie Z, Qin Q and Shen K (2020). The burden of respiratory syncytial virus associated with acute lower respiratory tract infections in Chinese children: A meta-analysis. *Transl. Pediatr.*, **9**: 496-506.

Yuan XS, Wang XD and Chen WB (2020). Analysis of influencing factors for recurrent upper respiratory tract infections in children aged 3-6 years. *Practical Prev. Med.*, **27**: 606-608.

Zhao H, Feng X and Yu R (2018). Validation of the Chinese version of the Readiness for Hospital Discharge Scale on patients who have undergone laryngectomy. *J. Nurs. Res.*, **24**: 321-328.

Zhu Y, Zheng T and Wei JH (2022). Advances in research on discharge readiness in hospitalized children and their caregivers. *Nurs. J.*, **37**: 102-105.