

# The Framework of NICU-discharge Plan System for Preterm Infants in Iran: Duties, Components and Capabilities

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## ABSTRACT

**Introduction:** The development of comprehensive discharge plan system Not only, will facilitate the discharge process, increase staff and parent satisfaction, improve the care of preterm infants, also reduce the human error. **Aim:** to determine duties, components and capabilities of NICU discharge plan system as a multidimensional tool for facilitating the complex process of transition preterm infants to the home and support parents for post-discharge care. **Method:** The descriptive and qualitative study conducted in 2017. Firstly by literature review, components of framework were determined in 38 statements under 3 major themes: duties, components, and capabilities and then related questionnaire was provided. Cronbach's alpha test was used to assess the reliability of the questionnaire. The result was more than 0.82 for all statements of questionnaire. The validity of the instrument was determined based on concepts in the valid scientific texts and comments of experts. The analysis was performed using SPSS software. **Result:** In overall, 29 experts participated in the consensus process. In the duties section, all of the statements reach more than 50% consensus. Among statements of the components and capabilities consensus was achieved in 12 out of 17, 12 out of 16 statements respectively. **Conclusion:** according to survey, checkout infant readiness determined as the main duty of the system. Alarm message for special examination before discharge and parent readiness checklist considered as the most important components. The ability to send alarm message, register and log in system were the key capabilities of the discharge system.

**Keywords:** patient discharge, infant, premature, Intensive Care Units, Neonatal.

## 1. INTRODUCTION

The process discharge of preterm infants is a very complicated issue that starts from admission time to discharge and post-discharge at home and health community (1, 2). Preterm infants need to special care, follow up, home visit and their parents need to psychological and educational support (2-4). On the other hand, prolonged hospitalization and re-admission rate would increase total cost and the burden of prematurity birth on health centers (5). Various intervention programs surveyed in different studies for improvement in discharge process, decreasing readmissions and Duration of stay in the hospital of preterm infants as an international priority surveyed in different studies (5-8). The most important of these interventions can be summarized in shortening the length of stay by early postpartum discharge (9-12), parental support program (13-16), formulating standards and guidelines,

re-engineering discharge process.

In various studies, the early discharge from neonatal intensive care unit (NICU) has been used as an intervention program in order to decrease readmissions rate and cost of the prematurity birth (9-12, 17, 18). However, the findings of the some studies showed that shortening length of stay, although have advantages such as the end of infant separation from the parent, reducing costs and nosocomial infections and increasing hospital productivity, but it may increase the morbidity and readmission rate (5, 18, 19). Therefore, improving the quality of preterm care should be considered in early postpartum discharge program.

Since the birth of a premature infant is a stressful, confusing and difficult event for parents, so far different intervention programs and studies were done based on the preparation of parents to accept the infant conditions and education of

them for the care and post-discharge follow up (13-16, 20). Re-engineering is a way to modifying the discharge process in accordance with the new strategies of health care centers and to facilitating the discharge process. In some studies, the effect of re-engineering the discharge process has been done on improving the care of the newborn and increasing the satisfaction of parents and staff from discharge process has been done. Brain W.Jack and et al used re-engineering discharge process for decreasing re-hospitalization (21). Over the years, numerous standards and guidelines including American Academy of Pediatrics(AAP) and Canadian pediatric society and the Society for obstetrician and gynecologists developed to determine the criteria for discharge infants from the neonatal intensive care unit (NICU) (22-26). Along with the interventions mentioned above, the development of the discharge plan has also been addressed in some studies related to adult discharge as a solution to the facilitation and implementation of the child and elderly hospital discharge process (6, 27-32).

Hence, developing a comprehensive NICU discharge plan will facilitate and simplify the discharge process, reduce human error, increase staff and parent satisfaction, and improve the care of preterm infants (2, 33, 34). Indeed, discharge plan should extend beyond criteria for physiologic stability of infants to family support for post hospitalization care needs (35-37). in this study, development of discharge plan system considered for preterm infants. Literature review highlighted that infant readiness, parent readiness and home environment, care plan and community and health systems readiness were the main requirements of the discharge plan for preterm infants (5, 35, 37). The differences in health care systems policies, how parental support are organized, and post-discharge needs might be effective on discharge plan framework (38).

## 2. AIM

Considering that well-designed discharge plan system for preterm infants reduce rates of hospital readmissions rate and cost while increasing parent confidence for their infant care at home but there is not the approved framework in Iran. The goal of this study was to determine the duties, components and capabilities of NICU discharge plan system for preterm infants as a multidimensional tool to facilitate making a decision for transitioning infant safety to home, providing advice for post-discharge visit, home care, medication, form and educate parents.

## 3. METHOD

This descriptive qualitative study was conducted in 2017 in Maternal-Fetal and Neonatal Research Center in Tehran.

### 3.1 Participants

We targeted 29 participants including 8 neonatologist, 11 pediatricians, 1 nurses, 3 midwives, 3 health information managers and, 3 health informatics experts. All of the participants have more than 3 years of working experience in NICU and in the field of health information technology. There were no age and sex exclusions for study entry.

### 3.2 Identification components of framework for NICU discharge plan system

Firstly, in order to the literature review, were searched key words including hospital discharge, discharge plan, preterm

infants, Neonatal Intensive Care Unit in scientific and authoritative data bases consist Science Direct, ProQuest, Scopus, Google Scholar, and PubMed without any time limitation and in the English language. Then, have studied standards and clinical guidelines related to discharge of preterm infants studied such as AAP guidelines and Neonatal-Perinatal medicine text books. Finally, a framework of discharge plan for preterm infants was developed. This framework including duties, components and capabilities of the system.

### 3.3 Instrument

A self-administered questionnaire was provided. The questionnaire consisted of 38 statements under 4 major themes of the framework: duties, clinician support components, parent support components and capabilities of system. Duties theme consist of 5 statements: clinician support, parent support components and capabilities consisted 8, 9 and 16 statements respectively. Cronbach's alpha test was used to assess the reliability of the questionnaire. The result is more than 0.82 for all statements of questionnaire. The validity of the instrument was determined based on concepts in the valid scientific texts, clinical guidelines and comments of experts. The analysis was performed using SPSS software version 21.

### 3.4 Data analysis

Descriptive statistics for each statement in the questionnaire were calculated to check whether the raw score of each statement reaches to 50 % of consensus. The experts were asked to review and score statements of duties, components and capability theme based on their importance by using a five-point Likert scale ranging from 1 to 5, where 1 referred to the concept of "low important" and 5 indicated the statement of "Strong important". (Strong Important (5) Quite a lot important (4) Moderate important (3) Slight important (2) Low important (1). Those statements that reached more than 50% of the agreement in score 5 and 4 were considered in the proposed framework. The level of statistical significance of agreed statements was set at p-value <0.05. Therefore, the statements considered for the proposed framework are not of the same importance. So finally, the statements were ranked based on the importance on developing the proposed system.

## 4. RESULTS

The results of this study were presented in three parts. The first part of the study includes the proposed duties of framework. The second part contains clinician and parent support components and the third part includes capabilities of the framework. The statements of duties and components of system scored as strong important (5) or quite a lot important (4) by more than 50 percent of the experts are presented in Table 1. Overall the most important statements of duties and components proposed for the final framework as follows respectively.

### 4.1 Proposed duties of NICU discharge plan system framework

Check out infant readiness for discharge, develop the care plan, check out parent readiness for discharge, decision making support for discharge time and send the text message to parents for reminding post-discharge visit plans and follow up time.

Duties	% respondent to 5 scale	% respondent to 4 scale	Mean	S.D	Mean rank	Ranking
S <sub>1</sub> : check out infant readiness for discharge	87.0	4.3	4.6	1.15	3.41	1
S <sub>2</sub> : develop post-discharge care plan	78.3	21.7	4.78	0.421	3.22	2
S <sub>3</sub> : check out parent readiness for discharge	52.2	8.7	3.69	1.60	3.00	3
S <sub>4</sub> : support clinicians to decision making for discharge time	69.6	17.4	4.43	1.03	2.91	4
S <sub>5</sub> : send text message to reminding post-discharge visit plan and follow up times.	73.9	13.0	4.39	1.26	2.46	5
<b>Components</b>						
<b>Component 1: Clinician Support</b>						
S <sub>1</sub> : post-discharge care advices for infant care at home	52.1	34.8	4.31	0.838	4.64	7
S <sub>2</sub> : post-discharge care plan	60.8	34.8	4.54	0.595	5.36	2
S <sub>3</sub> : post-discharge medication advices	56.5	39.1	4.50	0.597	5.25	4
S <sub>4</sub> : discharge preterm Infant readiness check list	60.8	30.4	4.50	0.672	5.30	3
S <sub>5</sub> : post-discharge supplemental nutritional advices	52.1	34.8	4.45	0.595	4.98	6
S <sub>6</sub> : post-discharge visit time	60.8	26.1	4.45	0.738	5.14	5
S <sub>7</sub> : Alarm messages for special examination before discharge	73.9	17.4	4.63	0.657	5.86	1
<b>Components</b>						
<b>Component 2: Parent Support</b>						
S <sub>1</sub> : Parent readiness checklist	52.1	43.8	4.27	0.935	5.30	1
S <sub>2</sub> : Educational advices about development stages infant	17.3	60.9	3.86	0.710	3.93	5
S <sub>3</sub> : Educational advices about infant care	21.7	65.2	3.95	0.843	4.50	3
S <sub>4</sub> : Educational advices about position sleeping	21.7	56.5	3.95	0.653	4.34	4
S <sub>5</sub> : Educational advices for recognizing the primary symptoms of current disease in preterm infants	26	65.2	4.13	0.560	4.95	2

Table 1. duties and components of NICU discharge plan framework for preterm infants

Capabilities	% respondent to 5 scales	% respondent to 4 scales	Mean	S. D	Mean rank	Ranking
S <sub>1</sub> : Automated log out	17.2	58.6	3.86	0.789	6.50	12
S <sub>2</sub> : Interchange with hospital information system	31.0	44.8	4.00	0.925	9.37	4
S <sub>3</sub> : Ability to alert for special examination before discharge	34.5	48.3	4.17	0.710	7.63	11
S <sub>4</sub> : The communication between the system users and the administrator of the NICU	55.2	37.9	4.41	0.824	9.27	7
S <sub>5</sub> : Easy access to information system without restriction time and place	51.7	44.8	4.44	0.685	9.33	5
S <sub>6</sub> : Register and log in system	62.1	34.5	4.58	0.568	10.37	1
S <sub>7</sub> : Ability to alert when parents are not ready for discharge of their infants.	55.2	20.7	4.27	0.921	8.92	10
S <sub>8</sub> : Access controlled to system based on roles of users	55.2	20.7	4.27	0.921	8.94	9
S <sub>9</sub> : Usability of system	55.2	24.1	4.31	0.890	8.98	8
S <sub>10</sub> : Analyzing and querying of information	58.6	27.6	4.37	0.902	9.31	6
S <sub>11</sub> : Ability to send a text message to parents for reminding post-discharge visit time and follow up	58.6	27.6	4.39	0.831	9.52	3
S <sub>12</sub> : Ability to send alert message for users when the infant is not ready to be discharged.	62	27.6	4.42	0.878	9.56	2

Table 2. Capabilities of NICU discharge plan system framework for preterm infants

### 4.2 Proposed components of NICU discharge plan system framework

The components of the system include two sections: Clinician support with 7 statements and parent support with 5 statements.

#### Clinician support component:

Alarm messages for special examination before discharge, Post-discharge care plan and advices.

Discharge preterm Infant readiness checklist, post-discharge medication advice, post-discharge visit time, post-discharge nutritional advices and post-discharge care advices for infant care at home.

#### Parent support components:

Parent readiness checklist, Educational advices for recognizing the primary symptoms current disease in preterm infants, Educational advices about infant care for parents, Educational advices about position sleeping infants, Educational advices about development stages infants.

### 4.3 proposed capabilities of NICU discharge plan system

Statements of capabilities of system scored as strong important (5) or quite a lot important (4) by more than 50 percent of the experts are shown in Table 2.

According to Table 2, the most capabilities required of NICU discharge plan system framework were related to Register and log in system, Ability to send alert message for users when the infant is not ready to be discharged, Ability to send a text message to parents for reminding post-discharge visit time and follow up of their infant, Interchange with hospital information system, Easy access to information system without restriction time and place, Analyzing and querying of information, The communication between the system users and the administrator of the NICU, usability of system, access control to system based on roles, ability to send alert message when parents are not ready for discharge of their infants, alarm for special examination before discharge and automated log out respectively.

## 5. DISCUSSION

In this study was proposed an NICU discharge plan system framework for preterm infants and put a survey among experts to reach the consensus. The results of this study showed that the most important duties of proposed system included check out infant readiness for discharge, develop post-discharge care plan and check out parent readiness for discharge. Alarm message for special examination before discharge and

parent readiness checklist considered as the chief components of system. Register and log in system, ability to send alert message for users when the infant is not ready to discharge and ability to send a text message to parents for reminding post-discharge visit time and follow up were the key capabilities of the discharge system.

In overall, final framework consisted 29 statements. Check out infant readiness for discharge (3.41), develop post-discharge care plan (3.22) and check out parent readiness for discharge (3.00) were determined as the most important duties of system. The components of final framework were included 12 statements and alarm messages for special examination before discharge (5.86), post-discharge care plan (5.36), parent readiness checklist (5.30) were the most important statements. The most capabilities of system were related to register and log in system (10.37), ability to send alert message for users when the infant is not ready to be discharged (9.56) and ability to send a text message to parents for reminding post-discharge visit time and follow up (9.52) respectively.

Clari Rose and et al, physiological maturity, parental readiness and home environment, and administrative/ infrastructure considered as discharge criteria (5). The AAP has recommended that discharge of preterm infants based on the evaluation of four dimensions of readiness for discharge: neonatal readiness, home care plan readiness, family and environmental readiness, and community and health systems readiness (39). Canadian Pediatrics Society identified broad spectrum before discharge evaluation of preterm from infant readiness assessment, preparing discharge team, promotion parental involvement with their infant to appropriate follow up plan (35). Robin K. Whyte V and et al defined effective discharge requirements including education and review of medications with parents, home and community support services (26). The most important statements of the duties, components and capabilities of the proposed framework are presented in Table 3.

The strength of this study was to develop an approved theoretical framework of NICU discharge plan system by clinical expert's consensus. However, it is imperative that the framework should be pretested in some health care centers to identify all deficiencies. The authors suggested that researchers survey the various method for integrating discharge plan system with hospital-based registry system and investigate appropriate technology for support parents at home for future research.

## 6. CONCLUSION

Evidently, the comprehensive NICU discharge plan will facilitate and simplify the discharge process, reduce human error, increase staff and parent satisfaction, and improve the care of preterm infants. However, in Iran an approved discharge plan, still does not exist for this group of high risk neonates. Therefore, the goal of this study was to determine the framework of NICU discharge plan system for preterm infants. According to literature review conducted on clinical guidelines and various studies regarding the NICU discharge plan system, Neonates, neonatologists and parents were identified as the dimensions of plan. The main parameters of plan included duties, components and capabilities. Parents have an active role in discharge planning and require support both

before and after discharge. Health care providers are responsible for ensuring that the family achieves these competencies along the continuum from NICU to home. Indeed, designing of discharge plan system for preterm infants requires a systematic, inter-professional and multidisciplinary approach. On the other hand, the health care policies, the variety of the parental support interventions, post-discharge needs, information and communication infrastructures and the knowledge and perceptions of clinical experts in different countries would be effective on developing the discharge plan for preterm infants. Therefore, the framework for NICU discharge plan developed by the view point of clinicians and information technology experts for Iran. Over all, if a discharge plan, completing parent education, decreasing length of stay, decreasing readmission rates can be an effective program for minimizing outcome of prematurity birth. Encouraging families and neonatologists to use the Internet and communication technologies such as telemedicine and information systems will help to reach the objectives of an interactive and continuous NICU discharge.

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