

# Breaking down barriers: enabling care-by-parent in neonatal intensive care units in China

Xiao-Ying Li, Shoo Lee, Hua-Feng Yu, Xiang Y Ye, Ruth Warre, Xiang-Hong Liu, Jian-Hong Liu

Jinan, China

**Background:** Denying parents access to their infant in the Neonatal Intensive Care Unit (NICU) is a standard practice in most hospitals across China. Visitation is not usually permitted or may be strictly limited, and NICU care for most neonates is provided by health-care professionals with little participation of the parents. An exception to this rule is the level 2 "Room-In" ward in Qilu Children's Hospital, Shandong University, where parents have 24-hour access to their infants and participate in providing care.

**Methods:** This retrospective cohort study compared the outcomes of infants who were admitted to the NICU and remained there throughout their stay (NICU-NICU group,  $n=428$ ), admitted to the NICU and then transferred to the Room-In ward (NICU-RIn group,  $n=1018$ ), or admitted straight to the Room-In ward (RIn only group,  $n=629$ ).

**Results:** There were no significant differences in the rates of nosocomial infection, bronchopulmonary dysplasia, intraventricular hemorrhage, and retinopathy of prematurity between the NICU-NICU and NICU-RIn groups. The rate of necrotizing enterocolitis was significantly lower in the NICU-RIn group ( $P=0.04$ ), while weight gain and duration of hospital stay were significantly higher (both  $P<0.001$ ). Rates of adverse outcomes were lower in RIn-only infants due to their low severity of illness on admission.

**Conclusions:** Allowing parents access to their infant in the NICU is feasible and safe in China, and may result

in improvements in infant outcomes. Further studies are required to generate stronger evidence that can inform changes to neonatal care in China.

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**Key words:** care-by-parent;  
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parental involvement

## Introduction

The family-centered approach to care in the Neonatal Intensive Care Unit (NICU) focuses on ensuring that parents play an active role in their infant's care and are able to provide the physiological and emotional support these vulnerable neonates need.<sup>[1,2]</sup> This is achieved by using a variety of approaches that usually include one or more of skin-to-skin/kangaroo care,<sup>[3-5]</sup> parent education,<sup>[6,7]</sup> and parent participation in decision-making and caregiving.<sup>[8-13]</sup> Of particular interest are those programs that promote "care-by-parent" where parents are fully integrated into the NICU care process and provide the majority of their infants' care.<sup>[8-10,12,13]</sup> These programs have been implemented in a variety of countries across the world including Canada,<sup>[8]</sup> Estonia,<sup>[9]</sup> Sweden,<sup>[10]</sup> Turkey,<sup>[12]</sup> and Pakistan,<sup>[13]</sup> and have shown that involving parents in the care of their infants in the NICU results in better short- and long-term outcomes for parents and their infants. These improvements include decreased maternal stress in the NICU,<sup>[8]</sup> improved infant weight gain,<sup>[8,9]</sup> reduced length of stay,<sup>[10,13]</sup> and decreased re-hospitalization and health service use following discharge.<sup>[12]</sup> Indeed, physical and emotional closeness through early skin-to-skin contact, extended visiting hours, rooming-in, and a welcoming NICU environment are crucial to the physical, emotional, and social well-being of both infants and their parents.<sup>[14]</sup> None of the benefits of these approaches are possible, however, if parents have

**Author Affiliations:** Neonatology Department, Qilu Children's Hospital Shandong University, Jinan, China (Li XY, Yu HF, Liu XH, Liu JH); Maternal-Infant Care Research Centre, Mount Sinai Hospital, Toronto, Ontario, Canada (Lee S, Ye XY, Warre R); Department of Pediatrics, University of Toronto, Ontario, Canada (Lee S)

**Corresponding Author:** Jian-Hong Liu, MD, No. 23976, Jingshi Road, Jinan, Shandong, China (Tel: +86-18866115155; Fax: +86-531-87964257; Email: etyyljh@126.com)

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little or no access to their infants in the NICU.

Standard practice in most hospitals across China either denies parents access to the NICU or limits them to one or two tightly controlled time-limited visits per day. The reasons for this are primarily due to concerns about infection control but may be compounded by traditional beliefs surrounding child birth. Traditionally, a new mother is expected to rest in bed at home for the first month after delivery and focus on following practices that keep her warm, shrink the uterus, and restore balance to her body. During this "sitting the month" period, new mothers are not supposed to leave the house, bathe, or wash their hair, and should protect themselves from the wind and cold to prevent the future development of arthritis and rheumatism.<sup>[15]</sup> Thus, a mother cannot participate in her infant's care if the infant is admitted to the NICU. Studies of the provision of developmental care in NICUs in China have also shown that the training and workload of nurses is such that they are able to provide an appropriate physical environment for a preterm infant but not individualized developmental care or family-centered care.<sup>[16]</sup>

At Qilu Children's Hospital, we believe that parents should be involved in the care of their infants. We have had a program in place in our NICU since 1995, where parents have the option of staying overnight ("rooming-in") with their infants and participating in providing care 24 hours a day. In this study, we compared the outcomes of two groups of infants who were admitted to our NICU: those who were subsequently transferred to the Rooming-In (RIn) ward and those who were eligible for admission to the RIn ward but remained in the NICU. Our objectives were to: 1) provide evidence that it is feasible for parents to participate in their infant's NICU care through rooming-in with them; and 2) identify if there were any differences in the short-term outcomes of neonates who initially received care in the NICU and then roomed in with their parents in the RIn ward compared with those cared for in the NICU by health-care professionals alone.

## Methods

### Rooming-In program

Qilu Children's Hospital, Shandong University has 30 NICU beds for the provision of level 3 care and 40 beds for the provision of level 2 care according to the American Association of Pediatrics guidelines.<sup>[17]</sup> The majority of the level 2 beds are in the RIn ward with 4 in an area of the NICU set aside for provision of level 2 care without any parent involvement. The RIn ward is a separate ward with 6 one-family, 12 two-family and 2 three-family rooms where parents room-

in with their infants and participate in providing care. For each family there is a bed for the parents and one for the infant with access to oxygen, as well as a bathroom, microwave, and TV. On the other hand, if infants are being provided with level 2 or 3 care in the NICU, standard care is provided by health-care professionals (physicians and registered nurses) without any participation from parents, who are allowed to visit the NICU twice a week. During the parents' visit, they usually meet with physicians in a separate room and are only allowed to visit their infants inside the NICU with the physicians' permission.

Depending on the severity of illness, infants can be admitted straight to the RIn ward or admitted to the NICU and then transferred to the RIn ward. The criteria for moving infants from the NICU to the RIn ward are that they are stable, receiving oral feeds, not receiving supplemental oxygen, and weigh more than 1500 g. As an infant's health improves, we consult with parents concerning transfer to the RIn ward. When infants are transferred to the RIn ward, parents or other relatives (e.g. grandparents, aunts) room-in with the infants as the primary caregivers with the expectation that at least one parent or other relative remains with the infant 24 hours a day. Those infants who are eligible for the RIn ward but whose parents or relatives are unable to room-in with them are moved to an area of the NICU set aside for the provision of level 2 care by health-care professionals. These infants are then discharged directly from the NICU with instruction for parents provided immediately before discharge on how to feed their infant, measure the infant's temperature, change diapers, administer oral medications, and keep track of the infant's progress including identifying problems requiring medical attention.

In the RIn ward, nurses take the role of educators and coaches for parents, who provide the majority of the infant's care with the exception of procedures such as insertion of peripheral intravenous lines, injections, tube-feeding, bathing, and writing clinical notes. Education of parents is central to the program, so a nurse will spend one and a half hours giving parents detailed training regarding the care of their infant on the first day after admission/transfer to the RIn ward. Further education is then given by doctors and nurses during the infant's hospital stay according to the needs of the parent and to ensure safe care of the infant. Care provided by parents includes feeding, measuring the infant's temperature, changing diapers, administering oral medications, participating in rounds, and updating the infant's information.

### Study design, population, and outcome measures

The outcomes of our RIn program were examined

using a retrospective review of medical chart data from all infants admitted to the NICU and RIn ward between January 1st, 2012 and December 30th, 2012. Very sick infants were admitted to the NICU first then either: 1) transferred to the RIn ward if their parents or other relatives were able to room-in with them, or 2) remained in the NICU if their parents were unable to room-in with them or there was not enough space in the RIn ward. Infants with mild problems such as fever, pneumonia, diarrhea, or jaundice were only admitted to and discharged from the RIn ward. As such, infants were classified into three groups: admitted to the NICU and then remained in the NICU even when eligible for the RIn ward (NICU-NICU), admitted to the NICU and then transferred to the RIn ward (NICU-RIn), and admitted to the RIn ward only (RIn only). The NICU-NICU and NICU-RIn groups were our primary groups of interest as these infants were hypothesized to be similar in characteristics before receiving differing approaches to care.

Demographic data, treatment characteristics, and outcomes throughout each infant's hospital stay were collected from a retrospective chart review using a predesigned data collection form and transferred to a database created in collaboration with the Canadian Neonatal Network™ (CNN). The CNN is a Canada-wide neonatal network that includes all tertiary-level NICUs in Canada and collects data on all admissions to those NICUs using a standardized data collection platform.<sup>[18]</sup> Data collected in this study included gestational age, birth weight, weight at discharge, small for gestational age status, Apgar score at 1 minute, maternal characteristics, infant diagnosis, length of stay, percentage weight change at discharge, mortality, nosocomial infection, bronchopulmonary dysplasia, necrotizing enterocolitis, intraventricular hemorrhage, retinopathy of prematurity, and so on. Data on the identity of the family member (e.g. mother, father, or extended family member) who took care of infants in the NICU-RIn and RIn only groups were not available.

The data were gathered retrospectively and no identifiable case information were published, so individual consent was not obtained. The collection of data was approved by the Qilu Children's Hospital Shandong University, Institutional Review Board for Human Subjects.

### Statistical analysis

Descriptive statistical methods were used to summarize the study population. To determine if allowing parents access to their infants has any adverse effects on infant outcomes, infant and maternal characteristics, infant diagnoses, major morbidities, length of stay, and weight gain were compared between the NICU-NICU and

NICU-RIn groups using the Chi-square or Fisher's exact test, as appropriate, for categorical variables, and the F or Wilcoxon Rank Sum test for continuous variables. As infants in the group admitted to the RIn ward only were assumed to have different baseline characteristics/initial diagnoses and were apparently much healthier compared with the NICU-NICU and NICU-RIn groups, the data for the RIn ward only group were summarized and compared descriptively, if applicable. To account for potential confounders, neonatal outcomes including mortality, nosocomial infection, bronchopulmonary dysplasia, intraventricular hemorrhage, necrotizing enterocolitis, retinopathy of prematurity, percentage weight change at discharge, and duration of hospital stay were further compared using multivariable regression analyses that included the covariates gender, birth weight, small for gestational age, large for gestational age, age at admission, and length of hospital stay. A sensitivity analysis evaluating only those infants that survived to discharge was also conducted to ensure that there was no bias due to the inclusion of infants who died and whose eligibility for the RIn ward was unknown. Data management and statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, North Carolina). A two-sided significance level of  $P < 0.05$  was used.

### Results

During 2012, 2081 infants were admitted to the NICU and/or RIn ward of Qilu Children's Hospital. Of these infants, 6 were excluded from this study due to incomplete data while the remaining 2075 infants formed the study population. The distribution of those infants into the NICU-NICU, NICU-RIn, and RIn only groups is shown in the Fig. Of the 2075 infants, 1647 (79.4%) were cared for by their parents either as part of the NICU-RIn group or the RIn only group. In terms of gestational age, 292 infants (14.1%) were

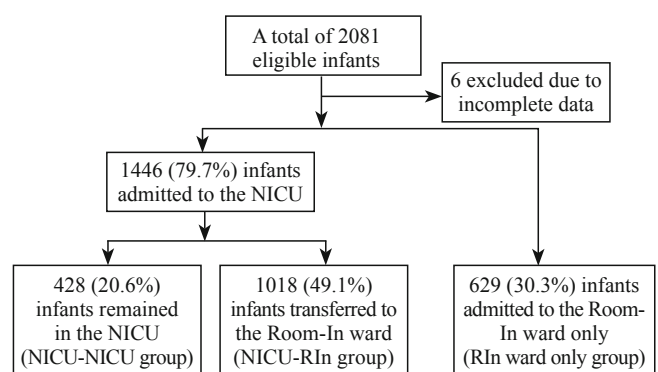


Fig. Patient flow chart.

born preterm at <36 weeks' gestation, of these infants 85 (29.1%) were admitted to the NICU and remained there, 188 (64.4%) were first admitted to the NICU and then transferred to the RIn ward, and 19 (6.5%) were admitted straight to the RIn ward.

Comparisons of the infants and maternal characteristics of the three groups are presented in Table 1. No statistically significant differences were observed in the majority of the characteristics of the NICU-NICU and NICU-RIn groups with the exception that infants who remained in the NICU despite becoming eligible for the RIn ward had a lower birth weight, a larger percentage were born small for their gestational age, and a larger percentage had an Apgar score of <7 at 1 minute after birth than those in the NICU-RIn group. For the maternal characteristics, mothers of infants who remained in the NICU had lower levels of education and a higher rate of maternal infection. As would be expected due to the need for admission to the RIn ward only, compared with the NICU-NICU and NICU-RIn groups infants in the RIn only group had a higher gestational age, greater birth weight, and fewer were small for their gestational age or had an Apgar score of <7 at 1 min after birth, although without significance. The rate of maternal infection was also lower in the RIn only group and mothers had a higher level of education and more were employed compared with the other two groups.

In terms of the diagnoses on admission (Table 2), there were no significant differences between the NICU-NICU and NICU-RIn groups in 13 out of the 20 diagnoses recorded; however, there were significantly more cases of asphyxia, congenital anomalies, inborn errors of metabolism, and respiratory failure in infants in the NICU-NICU group, and significantly more cases of diarrhea, jaundice, and pneumonia in the NICU-RIn group. In the RIn only group, the majority of infants were admitted due to jaundice, pneumonia, or diarrhea; rates of the other diagnoses surveyed were 1% or less.

The outcomes of the infants over the course of their hospital stay are shown in Table 3. The only deaths that occurred in the study population in 2012 happened in the NICU-NICU group. For the NICU-NICU and NICU-RIn groups, there was no significant difference in the rate of the 5 neonatal morbidities with the exception of necrotizing enterocolitis, which occurred in 1.9% of the NICU-NICU group and 0.7% of the NICU-RIn group ( $P=0.04$ ). For the RIn only group, with the exception of nosocomial infection, the rate of each neonatal morbidity was below 1%. In terms of weight gain and duration of hospital stay, infants in the NICU-RIn group had a significantly higher percentage weight change at discharge and a significantly longer duration of stay than the infants in the NICU-NICU group ( $P<0.001$ ). The infants in the NICU-RIn group stayed in the NICU for a mean time of 9.8 (standard deviation

**Table 1.** Infant and maternal characteristics of infants admitted to the Neonatal Intensive Care Unit (NICU) and Rooming-In (RIn) ward of Qilu Children's Hospital, Shandong University between January 1, 2012 and December 30, 2012

Characteristics	NICU-NICU (n=428)	NICU-RIn (n=1018)	P value*	RIn ward only (n=629)
Infant characteristics:				
Male gender, % (n)	64.0 (254)	64.5 (627)	0.85	64.4 (385)
Gestational age, mean (SD)	37.4 (3.3)	37.6 (2.9)	0.24	38.7 (1.6)
Birth weight, mean (SD)	2920 (782)	3009 (772)	0.04	3318 (535)
Small for gestational age, % (n)	23.8 (91)	17.4 (165)	0.008	10.0 (58)
Large for gestational age, % (n)	7.6 (29)	9.2 (87)	0.34	8.9 (52)
Apgar score <7 at 1 min, % (n)	22.8 (51)	13.1 (68)	<0.001	1.1 (3)
Maternal characteristics:				
Age, mean (SD), y	27.7 (5.3)	28.1 (4.9)	0.12	27.9 (4.5)
Education, % (n)				
≤6 y	13.7 (58)	8.2 (83)		6.1 (38)
6-12 y	63.3 (267)	60.8 (617)	<0.001	42.7 (267)
Post-secondary	13.3 (56)	19.3 (196)		25.4 (159)
University or higher	9.7 (41)	11.7 (119)		25.9 (162)
Employment status, % (n)				
Employed	28.8 (122)	31.8 (323)	0.26	50.3 (316)
Unemployed	71.2 (301)	68.2 (692)		49.7 (312)
Cesarean section, % (n)	51.4 (217)	50.8 (509)	0.82	54.7 (337)
Prenatal care, % (n)	83.7 (349)	87.0 (874)	0.11	84.2 (518)
Chorioamnionitis, % (n)	0.7 (3)	1.3 (13)	0.35†	0.6 (4)
Diabetes, % (n)	1.0 (4)	1.9 (19)	0.20†	2.1 (13)
Hypertension, % (n)	5.7 (24)	5.8 (59)	0.92	2.7 (17)
Maternal infections, % (n)	11.4 (48)	8.0 (81)	0.045	5.7 (35)

SD: standard deviation. \*: The reported P values are based on comparison between the NICU-NICU and NICU-RIn groups using the Chi-square or Fisher exact test for categorical variables (as indicated), and Student's *t* test for continuous variables; †: P value calculated using the Fisher's exact test.



**Table 2.** Diagnoses at admission for infants admitted to the Neonatal Intensive Care Unit (NICU) and Rooming-In (RIn) ward of Qilu Children's Hospital, Shandong University

Diagnoses	NICU-NICU (n=428)	NICU-RIn (n=1018)	P value*	RIn ward only (n=629)
Arrhythmia, % (n)	0.7 (3)	0.7 (7)	0.99 <sup>†</sup>	0.2 (1)
Asphyxia, % (n)	13.7 (58)	7.5 (76)	<0.001	0.6 (4)
Congenital anomaly, % (n)	7.6 (32)	2.8 (28)	<0.001	0.6 (4)
Congenital heart disease, % (n)	8.7 (37)	6.5 (66)	0.14	1.1 (7)
Diarrhea, % (n)	6.4 (27)	10.3 (104)	0.019	11.7 (73)
Hyaline membrane disease, % (n)	7.1 (30)	7.3 (74)	0.87	0.8 (5)
Hypoglycemia, % (n)	7.6 (32)	7.2 (73)	0.82	0.6 (4)
Inborn errors of metabolism, % (n)	1.7 (7)	0.6 (6)	0.05 <sup>†</sup>	1.0 (6)
Jaundice, % (n)	34.2 (145)	45.2 (457)	<0.001	55.9 (350)
Malnutrition, % (n)	0.9 (4)	0.9 (9)	0.92 <sup>†</sup>	0.6 (4)
Meconium aspiration, % (n)	3.3 (14)	1.9 (19)	0.10	0 (0)
Pneumonia, % (n)	55.2 (234)	63.3 (640)	0.004	74.0 (463)
Pneumothorax, % (n)	2.8 (12)	2.1 (21)	0.39	0.5 (3)
Poor feeding, % (n)	4.7 (20)	5.7 (58)	0.44	0.6 (4)
Persistent pulmonary hypotension, % (n)	5.4 (23)	4.6 (46)	0.48	0.3 (2)
Pulmonary hemorrhage, % (n)	3.5 (15)	2.0 (20)	0.08	0.2 (1)
Respiratory failure, % (n)	11.1 (47)	7.1 (72)	0.001	0.5 (3)
Seizures, % (n)	2.1 (9)	1.3 (13)	0.24	0.2 (1)
Surgery, % (n)	1.2 (5)	0.7 (7)	0.35 <sup>†</sup>	0.6 (4)
Transient tachypnea of the newborn, % (n)	2.8 (12)	2.8 (28)	0.94	0.2 (1)

\*: The reported *P* values are based on comparison between the NICU-NICU and NICU-RIn groups using the Chi-square or Fisher's exact test for categorical variables (as indicated), and Student's *t* test for continuous variables; †: *P* value calculated using the Fisher's exact test.

**Table 3.** Comparison of neonatal outcomes among infants admitted to the Neonatal Intensive Care Unit and Rooming-In Ward of Qilu Children's Hospital, Shandong University

Outcomes	NICU-NICU (n=428)	NICU-RIn (n=1081)	P value*	AOR (95% CI) <sup>‡</sup>	RIn Ward Only (n=629)
Mortality, % (n)	2.4 (10)	0 (0)	<0.001 <sup>†</sup>	NA	0 (0)
Bronchopulmonary dysplasia, % (n)	0.7 (3)	0.2 (2)	0.16 <sup>†</sup>	NA	0.2 (1)
Intraventricular hemorrhage, % (n)	7.1 (30)	8.7 (88)	0.31	0.80 (0.51, 1.26)	0.6 (4)
Necrotizing enterocolitis, % (n)	1.9 (8)	0.7 (7)	0.04 <sup>†</sup>	2.30 (0.73, 7.21)	0.2 (1)
Retinopathy of prematurity, % (n)	0.7 (3)	0.7 (7)	0.97 <sup>†</sup>	NA	0.2 (1)
Nosocomial infection, % (n)	11.3 (48)	9.9 (100)	0.41	1.19 (0.80, 1.76)	4.6 (29)
Percent weight change at discharge, mean (SD)	4.4 (15.9)	11.4 (19.9)	<0.001	-3.06 (-5.42, -0.69) <sup>§</sup>	17.1 (14.1)
Duration of hospital stay (days), mean (SD, range)	10.0 (11.6, 1-63)	16.8 (19.4, 1-108)	<0.001	-7.3 (-9.4, -5.3) <sup>§</sup>	10.2 (7.9, 1-101)

CI: confidence interval; NA: not available; SD: standard deviation. \*: The reported *P* values are based on comparison between the NICU-NICU and NICU-RIn groups using the Chi-square or Fisher's exact test for categorical variables (as indicated), and Student's *t* test for continuous variables; †: *P* value calculated using the Fisher's exact test; ‡: AOR, adjusted odds ratio (NICU-NICU vs. NICU-RIn), determined based on the final multiple logistic regression models for binary outcome derived by stepwise variable selection procedures; §: Difference in adjusted mean (95% CI) (NICU-NICU vs. NICU-RIn) determined based on final multiple linear regression models derived by stepwise variable selection procedures. The covariates included in the full models were gender, birth weight, small gestational age, large gestational age, age at admission and length of hospital stay (for all outcomes except duration of hospital stay).

8.6, range 1-62) days before being transferred to the RIn ward, where they stayed for a further mean time of 7.1 (6.2, 1-101) days. Infants admitted to the RIn ward only gained the most weight but had a similar duration of stay to those in the NICU-NICU group.

Multiple logistic regression analysis on the data from the NICU-NICU and NICU-RIn groups that adjusted for the differences in gender, birth weight, small for gestational age, large for gestational age, age on admission, and length of hospital stay indicated that there was no significant difference in the odds of intraventricular hemorrhage, necrotizing enterocolitis,

or nosocomial infection between the two groups. It was not possible to calculate an adjusted odds ratio for mortality, bronchopulmonary dysplasia, or retinopathy of prematurity as the number of cases of each was too small.<sup>[19]</sup> Adjustment of the data for percentage weight change and duration of hospital stay indicated that the percentage weight gain of infants in the NICU-NICU group was 3.1 percentage points less and their duration of hospital stay was 7.3 days less than those in the NICU-RIn group. Analysis of the data excluding infants that died gave the same results as the full data set (data not shown).

## Discussion

Our review of the characteristics and outcomes of infants admitted to our NICU and RIn ward indicates that this model is feasible in our hospital with 79% of all admitted infants cared for by their families once they were stable enough to be transferred to the RIn ward. Even in infants born at <36 weeks' gestation, 71% of parents took part in their infant's care. The data from the NICU-RIn group confirmed that the rates of mortality and the major neonatal morbidities for infants cared for by their parents were similar to those of infants that remained in the NICU for their entire stay. No adverse effects of allowing parents access to their infants were observed. In particular, the rate of nosocomial infection in infants in the NICU-NICU and NICU-RIn groups was similar (11.3% vs. 9.9%) and the rate in infants admitted to the RIn ward only was much lower (4.6%). The differences observed in infants that were admitted straight to the RIn ward most likely reflect their decreased severity of illness on admission. These rates are similar to those previously reported in studies of nosocomial infection in general NICU patient populations in China, which range from 3.1% to 17.2%,<sup>[20-25]</sup> and goes against one of the main arguments employed in China for limiting parental access to their infants due to their potential to spread infection.

Weight gain in infants from the NICU-RIn group was significantly greater than that of infants in the NICU-NICU group as was the length of stay. The longer length of stay observed in the NICU-RIn group was an unusual result as previous studies have indicated that care-by-parent programs result in a reduced length of stay.<sup>[10,13]</sup> Our result may have been due to the time taken for parents to adjust to their role in the RIn ward. Parents spent at least the first one to two days becoming familiar with their infant's care, then once they were comfortable they may want to remain in the ward for longer than required to make sure that their infant was healthy enough to be taken home. Our decision to discharge an infant from the RIn ward always includes consideration of the readiness of the parents to take the infant home. For infants in the NICU, we aim to discharge them as soon as possible so that they can be with their parents. Another possibility is that the longer length of stay indicates an adverse effect for the infants. The rates of jaundice, pneumonia, and diarrhea at admission were statistically significantly greater in the NICU-RIn group compared with the NICU-NICU group, which could have resulted in an increased mean length of stay for the NICU-RIn group. However, the rates of asphyxia, congenital anomalies, and respiratory failure at admission were higher in the NICU-NICU group, which would have an effect of increasing the mean length of stay for these infants. These data,

however, are unadjusted, are not likely to increase the length of stay for one group versus the other, and are a reflection of differences in the case mix of the two groups rather than an effect of parent involvement in care as they describe diagnoses at admission.

Although integrating families into the care of their infants in the NICU has been successful in other countries,<sup>[8-10,12,13]</sup> the lack of evidence from NICUs in China may be one of the major barriers to implementing a program like the one we describe here. Very few Chinese NICUs have any experience with this type of activity and only a few reviews with little authority have been published to introduce the benefits of parent involvement in the NICU.<sup>[26-28]</sup> Most of the related literature currently available in China focuses mainly on how parents should care for their preterm infant once discharged home. However, we feel that our program can serve as a model of how the barriers to more parent involvement can be broken down; and we don't know why similar programs cannot be implemented and tested more widely across China.

Although this is a single center's experience, our results indicate that involving parents in the care of their infant in the NICU is feasible and safe. Our program has been implemented for 19 years and was inspired by the launch and growth of the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Baby Friendly Hospital Initiative, which promotes rooming-in and breastfeeding.<sup>[29]</sup> Feedback from the parents in our unit is that more and more parents want to have access to their infant in the NICU and to be involved in their infant's care. Our program is popular both with parents and with the medical staff, who feel they are able to build a good relationship with parents. We have also observed that the traditional beliefs around women and their activities following delivery are declining in well-educated parents, who realize that the practice of remaining at home and not washing is unhealthy and unreasonable. While our unit may seem unusual, we would like to point out that Jinan is a typical moderate and traditional city in North China, the population characteristics are similar to other cities and NICUs in China, so the setting should be acceptable to Chinese neonatologists.

Another aspect of the program that could be used for promoting the care-by-parent model is the fact that anecdotally we have seen a reduction in the human resources needed to staff our units. With the involvement of parents, fewer nurses are needed to take care of the infants and neonatologists can concentrate on caring for the sickest infants. This may be the greatest stimulator of change in the Chinese NICU care system, as there is a trend of decreasing public contribution to health-care costs in China.

Involvement of parents may also improve long term neurodevelopmental and cognitive outcomes,<sup>[30-34]</sup> which is a priority for Chinese neonatal care. The final mechanism for change as a result of this program is the voice of neonatologists and NICU staff themselves; through greater inter-institutional dialogue and exchange of information and expertise, dogma can be challenged and new ways of providing care implemented.

Our study is limited by its retrospective nature and as such was not designed to rigorously evaluate the impact of parent involvement in their infant's care, but only to show that parent involvement is feasible and safe according to our experience. The patient population was also heterogeneous and included infants that only required level 2 neonatal care, as well as those that required level 3 care. The infants that required only level 2 care formed the RIn only group and their results were presented separately as secondary data that could not be compared with the NICU-NICU and NICU-RIn groups. As such, evidence of any benefits of involving parents in the care of the infants in this group was not available due to the lack of a comparison group. In addition, the neonatal outcomes measured are those of each infant's entire NICU stay and cannot be attributed specifically to the NICU or RIn period for those infants in the NICU-RIn group.

The arrangement of our program is unique and future studies of parent involvement in Chinese NICUs may not choose to follow our care pathway. However, this report confirms at least that the rooming-in model of care is feasible in a Chinese NICU, there were no adverse effects, and there may be positive effects on weight gain of infants. Further study is definitely needed to explore the possibilities of this model of care, investigate the relationship between parent involvement and length of stay, and provide convincing evidence to stimulate change. Such studies would need to account for any underlying differences in the NICU-NICU and NICU-RIn infant groups, such as conditions that limit parent participation. We also need to more closely examine the parent, infant, and healthcare provision dynamic and the factors that determine parents' ability to effectively care for their infants.

The practice of restricting parents' access to the NICU because they are potential sources of infection is outdated and has been phased out in many countries. It is time for the standard of care in China to change and recognize that quality parent-infant interaction in the first days and months of life is essential to the physical and psychological well-being of both parent and infant, improves care, and should be universal. The stimulation for this change should come from evidence-based trials of novel programs, inter-institutional

dialogue and collaboration, and the cost reductions and quality improvements achieved through implementing this model of care. Reports such as this one should encourage further investigation of care-by-parent models in China with careful evaluation of possible quality improvements and cost reductions.

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**Contributors:** LXY conceived and designed the project, drafted the initial manuscript. LS and LJH co-designed the project, reviewed and revised the manuscript. YHF and LXH organized, collected, and prepared the data for the manuscript, reviewed the manuscript. YXY analyzed the data, reviewed and revised the manuscript. WR interpreted the data, assisted in drafting the initial manuscript. All authors approved the final manuscript as submitted. LXY is the guarantor.

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